

**Educational videos for preschool children:
challenges and strategies for creating and distributing content
on digital platforms**

Doctoral Thesis in Digital Media
Tese de Doutoramento em Media Digitais

(October, 2022)

Dissertation submitted in accordance with the requirements for the degree of Doctor of Philosophy
in Digital Media under the scientific supervision of Professor Paulo Nuno Vicente (Ph.D.) and
Professor Cristina Ponte (Ph.D.)

Tese apresentada para cumprimento dos requisitos necessários à obtenção do grau de
Doutor em Media Digitais, realizada sob a orientação científica do Professor Doutor Paulo Nuno
Vicente e da Professora Doutora Cristina Ponte

Financial support

Apoio financeiro

FCT
Fundação
para a Ciência
e a Tecnologia

DECLARAÇÕES

Declaro que esta tese é o resultado da minha investigação pessoal e independente.
O seu conteúdo é original e todas as fontes consultadas estão devidamente mencionadas
no texto, nas notas e na bibliografia.

A candidata,

Gisela dos Santos Machado Couellhas

Lisboa, 5 de outubro de 2022

Declaro que esta tese se encontra em condições de ser apreciada pelo júri a
designar.

O orientador,

Assinado por: **PAULO NUNO GOUVEIA VICENTE**
Num. de Identificação: 12385242
Data: 2022.10.07 13:43:29+01'00'

Lisboa, _____ de _____ de 2022

Declaro que esta tese se encontra em condições de ser apreciada pelo júri a
designar.

A coorientadora,



Assinado por: Maria Cristina
Mendes da Ponte
Identificação: B104720307
Data: 2022-10-11 às 15:18:56

Lisboa, _____ de _____ de 2022

À minha família,

Aos meus amigos e amigas,

A quem acreditou neste projeto.

ACKNOWLEDGMENTS

This work allowed me to meet and work with amazing people, without whom it would not have been possible to take this journey.

I am profoundly thankful to my supervisors, Professor Paulo Nuno Vicente and Professor Cristina Ponte, who patiently guided me and taught me how to be a better researcher and human being.

I am also grateful to Professor Nuno Correia and Professor Margarida Lucas for being part of the initial jury of my dissertation project and advising me on my work. Also, I sincerely thank Professor Helena Rodrigues and Professor Ana Isabel Pereira for making me rethink how children learn music, and to Professor João Mário Grilo for showing me how the world can be seen through the eye of a lens.

I am thankful for the support and love of my parents. I thank Paulo and Délia, my life companions, Mário, for always helping me to overcome challenges, and Gena and Joana for being such inspiring women and good friends.

This work would not have been possible without those who cooperated in recruiting the participants for the studies. As such, I would like to express my most profound appreciation to Ana Umbelino, Councillor for Culture of the Municipality of Torres Vedras, and to Joana Maia and Maria João Fernandes, from the education service department of Fábrica das Histórias – Casa Jaime Umbelino. In addition, I am profoundly grateful to Professor Paulo Campino, Professor Luís Pedro Sousa, and Professor Mafalda Vicente from Colégio do Sagrado Coração de Maria, as well as to all the kindergarten teachers and families who accepted to participate in the studies.

I am also grateful to Diogo and to the children of Academia do Som, who embraced the project of *Lara no País da Música*, and to Érica and my grandmother for always guiding me.

Finally, I would like to express my deepest appreciation to the Portuguese Foundation for Science and Technology (FCT) for funding and supporting this work.

PERSONAL STATEMENT

This first-person-written statement aims to explain the motivation behind this work, which dates back to 2014 when I was still writing my Master's dissertation about educational services at museums, and I found a book named *Children's Learning from Education Television: Sesame Street and Beyond* (Fisch, 2004). My research back then focused on how children learn at museums, so even though that book was not within the scope of the investigation I was conducting at the time, I decided that after finishing my Master's degree, I would focus on how children learn from audiovisual media.

I learned how to read with the Portuguese adaptation of *Sesame Street* while my grandmother was preparing dinner and I was alone in the living room, in front of the television. So, I already knew that learning from audiovisual media was possible. What I did not know was why and how. Many years after, when I started working as a music teacher at the age of 19, in 2003, I realized that the local productions of educational media for children in Portugal had drastically decreased, and I started wondering how I could contribute to reversing the situation. This question followed me for many years until I found the Ph.D. in Digital Media at NOVA School of Social Sciences and Humanities and decided that it was my opportunity to resolve it.

My major passions in life are research, education, audiovisual and music creation and production, digital media, communication sciences, and cognitive neuroscience, so I investigated how these fields can be combined in the creation of educational media and somehow tried to find my *Ikigai* in this work.

I truly believe that the key to creating good quality educational products is to bring together academic researchers and producers so that the productions can be informed of what is scientifically proven to be pedagogically effective. I think many cooperation opportunities are lost because people tend to close themselves in clusters instead of sharing their knowledge and experience. Therefore, with this work, I hope to contribute to joining together researchers and producers in a debate on how to produce educational content that can be effective and engaging for preschool children, allowing them to learn and live memorable learning experiences that are kept for life. This is what *Sesame Street* still means to me.

EDUCATIONAL VIDEOS FOR PRESCHOOL CHILDREN: CHALLENGES AND STRATEGIES FOR CREATING AND DISTRIBUTING CONTENT ON DIGITAL PLATFORMS

Gisela dos Santos Machado Canelhas

ABSTRACT

Digital video streaming platforms such as YouTube allow every agent to upload videos and freely access the available content, representing a democratic and flexible model of audiovisual creation and distribution. Nevertheless, content filtering and recommendation are made by algorithms that select what is statistically most likely to please the user, regardless of the quality of the content (Covington, Adams & Sargin, 2016). Since children often use YouTube autonomously, without adult supervision, they may be exposed to videos that can be inappropriate or inadequate for their development and that do not promote learning (Blumberg, Brooks, Powers & Marcial, 2017). Thus, from the perspective of an audiovisual producer, it is paramount to know how to produce appealing and good-quality educational content from the beginning (Fisch, 2017). Furthermore, as the recommendation system of the algorithms can affect the visibility of content (McKelvey & Hunt, 2019), it is crucial to know the digital behavior and preferences of the target audience to design a complementary distribution strategy.

Bearing this in mind, we aim to identify potential challenges that digital platforms pose for creating, producing, and distributing educational videos for preschool children, and to investigate strategies for addressing these challenges from the perspective of the audiovisual producer. This is a topic still little explored in the literature, so this work aims to contribute to the State of the Art in the field of Digital Media. We investigate the challenges and strategies for addressing them in four areas: discourse, design, production, and distribution (the stages of conception of an audiovisual product defined by Kress & Leeuwen, 2001). After identifying the potential challenges in the literature, we investigate how to address them through a literature review and five studies conducted with 186 Portuguese preschool children and 134 families.

The results of this work suggest that even though learning from videos is a demanding task for preschool children, using cognitive and pedagogical strategies can enhance their learning outcomes. In addition, engagement with the videos leads to better learning performance. Thus, the producers should focus on edutainment products. The use of editing, alternating closer and wider shots, is not problematic if the characters are centered on the screen. Nonetheless, other editing techniques should be used with caution. Furthermore, local productions should be privileged instead of dubbed content. Finally, producers should make production choices considering that the consumption devices are mainly small and medium screen sizes. To maximize the visibility of the content, producers should focus on building a digital community of viewers, starting from families with preschool children and kindergarten teachers.

This work also encompasses an applied research part, in which we demonstrate how we applied the results of our research in the creation of an educational series about music education. We also present a summary of the recommendations for creators and producers of educational audiovisual content for preschool children.

KEYWORDS: educational videos; digital media and children; children and YouTube; learning with digital media; education and technology; preschool children

EDUCATIONAL VIDEOS FOR PRESCHOOL CHILDREN: CHALLENGES AND STRATEGIES FOR CREATING AND DISTRIBUTING CONTENT ON DIGITAL PLATFORMS

Gisela dos Santos Machado Canelhas

RESUMO

As plataformas de streaming de vídeo como o YouTube permitem que qualquer entidade disponibilize vídeos e aceda ao conteúdo disponível de forma gratuita, o que representa um modelo flexível e democrático de criação e distribuição audiovisual. Contudo, a filtragem e recomendação de conteúdo é feita por algoritmos que privilegiam o que é mais provável ser do agrado do utilizador, independentemente da qualidade do conteúdo (Covington, Adams & Sargin, 2016). Dado que as crianças utilizam frequentemente o YouTube de forma autónoma, sem a supervisão de um adulto, estas podem estar expostas a vídeos que podem ser inapropriados ou inadequados ao seu desenvolvimento e que não promovem a aprendizagem (Blumberg, Brooks, Powers & Marchial, 2017). Consequentemente, do ponto de vista de um produtor audiovisual, é fundamental saber como produzir conteúdo eficaz e apelativo desde o início da sua produção (Fisch, 2017). Além disso, dado que a recomendação feita por algoritmos pode afetar a visibilidade do conteúdo (McKelvey & Hunt, 2019), é importante conhecer o comportamento e preferências digitais do público-alvo de modo a desenhar uma estratégia de distribuição complementar.

Considerando o exposto, este trabalho visa identificar os potenciais desafios que as plataformas digitais representam para a criação, produção e distribuição de vídeos educativos para crianças em idade pré-escolar e investigar as estratégias de resposta a estes desafios do ponto de vista de um produtor audiovisual. Este é um tópico ainda pouco explorado na literatura, pelo que este trabalho pretende contribuir para o Estado da Arte no campo dos Media Digitais. Investigámos os desafios e estratégias de resposta em quatro áreas: discurso, design, produção e distribuição (os estágios de conceção de um produto audiovisual definidos por Kress & Leeuwen, 2001). Após identificarmos os potenciais desafios na literatura, investigamos como lhes responder através de revisão de literatura e de cinco estudos realizados com 186 crianças portuguesas em idade pré-escolar e 134 famílias.

Os resultados deste trabalho sugerem que apesar de ser difícil a aprendizagem através de vídeos no que diz respeito a crianças em idade pré-escolar, o uso de estratégias cognitivas e pedagógicas pode melhorar os resultados dessa aprendizagem. Além disso, o *engagement* com os vídeos leva a uma melhor aprendizagem. Consequentemente, os produtores devem focar-se em conteúdos que sejam simultaneamente educativos e de entretenimento (*edutainment*). O uso de técnicas de edição que alternem planos gerais e aproximados não revela ser problemática, desde que as personagens estejam centradas no ecrã. Contudo, outras técnicas de edição devem ser usadas com precaução. Além disso, as produções locais devem ser privilegiadas em detrimento de conteúdo dobrado. Por fim, os produtores devem tomar decisões de produção considerando que os dispositivos utilizados têm maioritariamente ecrãs de pequena e média dimensão. De modo a maximizar a visibilidade do conteúdo, os produtores devem apostar na construção de uma comunidade digital de visualizadores, começando por famílias com crianças em idade pré-escolar e educadores.

Este trabalho compreende ainda uma parte de investigação aplicada, na qual descrevemos o modo como aplicámos os resultados desta investigação na criação de uma série educativa sobre educação musical. Apresentamos também um resumo das recomendações para criadores e produtores de conteúdo educativo audiovisual para crianças em idade pré-escolar.

PALAVRAS-CHAVE: vídeos educativos; media digitais e crianças; crianças e YouTube; aprender com media digitais; educação e tecnologia; crianças em idade pré-escolar

TABLE OF CONTENTS

Introduction.....	1
1. Objectives of the work.....	7
2. Methods: Research questions and empirical design.....	12
Part I – Fundamental research	
Chapter 1 – Children in front of a screen: preliminary considerations on childhood and audiovisual media for children	19
Chapter 2 – A multimodal conception of an educational video: discourse, design, production, and distribution on digital platforms.....	29
2.1. The Discourse	29
2.2. The Design	61
2.3. The Production	87
2.4. The Distribution	99
Chapter 3 – Research Design	106
3.1. Study 1 – Producing educational videos for preschool children: the importance of using cognitive and pedagogical strategies to enhance learning.....	111
3.2. Study 2 – Digital devices and learning: the influence of the screen size on learning outcomes and engagement of preschool children with educational videos.....	131
3.3. Study 3 – First-order editing techniques and learning from educational videos: the effects of using cuts and different shot types on preschool children.....	147
3.4. Study 4 – Does the source language matter for learning? The impact of dubbing educational videos for preschool children on learning outcomes	165
3.5. Study 5 – Bypassing the algorithm? Exploring the potential of families to increase the visibility of educational content for children	177
3.6. General discussion	188
Part II – Applied research	
Chapter 4 – Lara in Musicland: an educational project of applied research	198
4.1. The discourse	202
4.2. The design	203
4.3. The production.....	205
4.4. The distribution	210
Conclusions.....	211
References.....	218
Appendices.....	238

LIST OF TABLES AND FIGURES

List of tables

No.	Title	Location	Page
1	Areas, research questions, and methodology of this work (source: the author)	Introduction; section 2	17
2	Action (mensurable) verbs for each stage within the Learning Taxonomy of Bloom (source: adapted from Newton, da Silva & Peters, 2020; original stages renamed and revised by Anderson & Krathwohl, 2001)	Chapter 2; section 2.1	44
3	Categories and salient behaviors of engagement in preschool children when interacting with e-books (source: adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014)	Chapter 2; section 2.1	56
4	Categories and salient engagement behaviors in preschool children when interacting with diverse mobile applications (source: adapted from Noorhidawati, Ghalebandi & Hajar, 2015)	Chapter 2; section 2.1	57
5	Examples of first, second, and third-order editing rules and corresponding violations (source: adapted from Munk, Diergarten, Nieding, Ohler & Schneider, 2012; Munk, Rey, Diergarten, Nieding, Schneider & Ohler, 2012; and Germeys & d'Ydewalle, 2007)	Chapter 2; section 2.3	94
6	Inclusion/exclusion table for the participation in studies 1-4 (source: the author)	Chapter 3; introduction	107
7	Initial samples of studies 1-4 (source: the author)	Chapter 3; introduction	108-109
8	EVAT Questionnaire targeted at families and kindergarten teachers (source: the author)	Chapter 3; section 3.1	113
9	Summary of the cognitive and pedagogical strategies highlighted in the reviewed literature (source: the author)	Chapter 3; section 3.1	114-115
10	Results of the language skills pre-test of Study 1 (source: the author)	Chapter 3; section 3.1	116
11	Final sample of Study 1 (source: the author)	Chapter 3; section 3.1	116
12	Sample characteristics of Study 1 (source: the author)		117-118
13	Cognitive and pedagogical strategies applied in the production of the video segments (source: the author)	Chapter 3; section 3.1	119
14	Plot and screenshots of the video segments (source: the author)	Chapter 3; section 3.1	120
15	Hypotheses of the study, considering the group conditions (source: the author)	Chapter 3; section 3.1	122
16	Crosstabulation analysis (score/group) of Study 1 (source: SPSS software)	Chapter 3; section 3.1	123
17	Summary of the results of the independent-sample proportions test (paired between groups) (source: the author)	Chapter 3; section 3.1	124

18	Results of the bivariate correlations analysis (source: SPSS software)	Chapter 3; section 3.1	125
19	Results of the hypotheses of Study 1, considering the group conditions (source: the author)	Chapter 3; section 3.1	126
20	Scoring criteria for the EVAT questionnaire (source: the author)	Chapter 3; section 3.1	128-129
21	Categories and salient engagement behaviors in preschool children when watching educational videos (source: the author, adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015)	Chapter 3; section 3.2	132
22	Results of the language skills pre-test of Study 2 (source: the author)	Chapter 3; section 3.2	134
23	Final sample of Study 2 (source: the author)	Chapter 3; section 3.2	134
24	Sample characteristics of Study 2 (source: the author)	Chapter 3; section 3.2	135-136
25	Plot of the video segment (source: the author)	Chapter 3; section 3.2	137
26	Coding rules for salient behaviors of engagement when watching the video segment (source: the author, adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015)	Chapter 3; section 3.2	138-139
27	Registration of the salient engagement behaviors of participants while watching the video segment (source: the author, adapted from adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015)	Chapter 3; section 3.2	139
28	Hypotheses of the study, considering the group conditions (source: the author)	Chapter 3; section 3.2	140-141
29	Crosstabulation analysis (score/group) of Study 2 (source: SPSS software)	Chapter 3; section 3.2	141
30	Summary of the results of the independent-sample proportions test (paired between groups) (source: the author)	Chapter 3; section 3.2	142
31	One-way ANOVA analysis of engagement/group (source: SPSS software)	Chapter 3; section 3.2	143
32	Results of the bivariate correlations analysis engagement/score (source: SPSS software)	Chapter 3; section 3.2	144
33	Results of the crosstabulation analysis (engagement/score) (source: SPSS software)	Chapter 3; section 3.2	144
34	Hypotheses of the study, considering the group conditions (source: the author)	Chapter 3; section 3.2	145
35	Inclusion/exclusion table for the selection of materials for study 3.1 (source: the author)	Chapter 3; section 3.3	149
36	List of the videos analyzed in study 3.1 (source: the author)	Chapter 3; section 3.3	150
37	Details of the videos analyzed in the present study (title, length, ASL, and SDASL) (source: the author)	Chapter 3; section 3.3	151
38	Frequency of each shot type per episode (source: the author)	Chapter 3; section 3.3	152

39	Details of the shots used in producing the video stimulus for study 3.2 (scene type, shot type, shot length, and ASL) (source: the author)	Chapter 3; section 3.3	153-154
40	Results of the language skills pre-test of Study 3.2 (source: the author)	Chapter 3; section 3.3	156
41	Final sample of the study (source: the author)	Chapter 3; section 3.3	156
42	Sample characteristics of Study 3.2 (source: the author)	Chapter 3; section 3.3	157-158
43	Plot of the video segment (source: the author)	Chapter 3; section 3.3	159
44	Hypothesis of the present study, considering the group conditions (source: the author)	Chapter 3; section 3.3	161
45	Crosstabulation (score/group) (source: SPSS software)	Chapter 3; section 3.3	161
46	Summary of the results of the independent-sample proportions test (paired between groups) (source: the author)	Chapter 3; section 3.3	162
47	Hypothesis of the present study, considering the group conditions (source: the author)	Chapter 3; section 3.3	163
48	Results of the language skills pre-test of Study 4 (source: the author)	Chapter 3; section 3.4	166
49	Final sample of the study (source: the author)	Chapter 3; section 3.4	167
50	Sample characteristics of Study 4 (source: the author)	Chapter 3; section 3.4	168-169
51	Plot of the video segments (source: the author)	Chapter 3; section 3.4	170
52	Hypotheses of the study, considering the group conditions (source: the author)	Chapter 3; section 3.4	172
53	Crosstabulation (score/group) (source: SPSS software)	Chapter 3; section 3.4	172
54	Summary of the results of the independent-sample proportions test (paired between groups) (source: the author)	Chapter 3; section 3.4	173
55	Crosstabulation analysis (score/group) layered by age (source: SPSS software)	Chapter 3; section 3.4	174
56	Hypotheses of the study, considering the group conditions (source: the author)	Chapter 3; section 3.4	175
57	Sample characteristics of Study 5 (source: the author)	Chapter 3; section 3.5	180-181
58	Description of the terms identified in the keywords and their categorization (source: the author)	Chapter 3; section 3.5	182
59	Research questions of this work (source: the author)	Chapter 3; section 3.6	188-189

List of figures

No.	Title	Location	Page
1	Learning Taxonomy of Bloom (original stages renamed and revised by Anderson & Krathwohl, 2001) (source: the author)	Chapter 2; section 2.1	43
2	Screenshot of the website dedicated to the EVAT instrument (www.evat.pt) (source: the author)	Chapter 2; section 2.1	112
3	Shot frequency and ASL of the dialogue scenes in all the analyzed videos from <i>Blue's Clues & You</i> (source: the author)	Chapter 3; section 3.3	152
4	Shot frequency and ASL of the dialogue scenes in all the analyzed videos from <i>Sesame Street</i> (source: the author)	Chapter 3; section 3.3	153
5	Shot frequency and ASL of the video stimulus to be used in Study 3.2 (source: the author)	Chapter 3; section 3.3	154
6	Visit frequency to websites and social media profiles dedicated to educational videos for children (source: the author)	Chapter 3; section 3.4	183
7	Valued aspects in websites and social media profiles dedicated to educational videos for children (source: the author)	Chapter 3; section 3.4	184
8	Frequency of use of digital devices for consuming videos (source: the author)	Chapter 3; section 3.4	184
9	Screenshot of the YouTube channel <i>Lara no País da Música</i> (source: the author)	Chapter 4; section 4.1	199
10	Screenshots of video clips of the songs (source: the author)	Chapter 4; section 4.1	199
11	Screenshot of the characters of <i>Lara no País da Música</i> [<i>Lara in Musicland</i>]: Lou, Leo, Lara, Lisa, and Lucas (from left to right) (source: the author)	Chapter 4; section 4.1	200
12	Concert at Natalis – Lisbon (December 2019) (source: the author)	Chapter 4; section 4.1	200
13	Concerto at Colombo Shopping Center – Lisbon (December 2019) (source: the author)	Chapter 4; section 4.1	200
14	Screenshot of the website of the project (source: the author)	Chapter 4; section 4.1	201
15	Screenshot of the Facebook profile of the project (source: the author)	Chapter 4; section 4.1	201
16	Screenshot of the Instagram profile of the project (source: the author)	Chapter 4; section 4.1	202
17	Green screen room of video capture (source: the author)	Chapter 4; section 4.3	205
18	Green screen room of video capture with furniture and toys (source: the author)	Chapter 4; section 4.3	205
19	Screenshot of the opening (final frame) (source: the author)	Chapter 4; section 4.3	206
20	Screenshot of the preface (section 1) (source: the author)	Chapter 4; section 4.3	207
21	Screenshot of a transition effect (source: the author)	Chapter 4; section 4.3	207

22	Screenshot of main part A (section 2) (source: the author)	Chapter 4; section 4.3	207
23	Screenshot of the reinforcement song (section 3) (source: the author)	Chapter 4; section 4.3	208
24	Screenshot of main part B (section 4) (source: the author)	Chapter 4; section 4.3	209
25	Screenshot of the summary (section 5) (source: the author)	Chapter 4; section 4.3	209

INTRODUCTION

The digital boom in the last ten years changed the dynamics of media use within families and is having an exponential growth year after year, encompassing more features and uses while changing the landscape of several industries, especially the audiovisual media industry (Lauricella, Blackwell & Wartella, 2017). The children born within this context are shifting more and more from traditional to digital media channels and platforms, and using these platforms is an important part of their lives and learning sources from a very young age (Dias & Brito, 2018). However, the fast change in the platforms is raising challenges and concerns for every agent that is interested in the well-being of the children (Courage, 2017).

Within the digital media industry, the need to push the production of supposedly educational products to meet an increasing demand by the viewers has led to the labeling of many objects as such without accurately assessing neither their pedagogical, cognitive, or social effects (Blumberg, Brooks, Powers & Marcial, 2017). This lack of assessment has raised concerns and skepticism among families, kindergarten teachers, and the medical community, who claim that unrestricted access to digital media can hinder the acquisition of crucial cognitive socioemotional skills instead of promoting development and learning (Rato & Castro-Caldas, 2017).

Furthermore, digital streaming platforms such as YouTube are flexible in content creation and distribution since everyone can upload videos to it and freely access the uploaded content. Although digital platforms can democratize media production and distribution, the available content is often recommended to viewers by algorithms that do not necessarily select good quality content over what is most appealing or trending (Covington, Adams & Sargin, 2016). Even though some platforms already encompass human curatorship before content distribution, such as Kidoodle, these are paid services that focus on safety, not pedagogical quality.

Therefore, when using digital platforms, children are often exposed to videos that can be inappropriate or inadequate to them and that do not provide effective learning. This issue is especially alarming in what concerns preschool children, since the quality and the quantity of the stimuli to which children are exposed in preschool

age can strongly influence the development of the human brain and cognitive functions (Blakemore & Frith, 2009; Rato & Castro-Caldas, 2017; Sousa, 2017).

Bearing this in mind, this work aims to identify and address challenges that digital streaming platforms represent for creating, producing, and distributing pedagogical and effective educational videos targeted at preschool children (3-5 years old). These challenges emerge from the cultural impact that derives from the use of new media and technology, being a consequence of a process of transcoding (Manovich, 2001), in which the computer layer (the algorithms of the platforms) shapes the cultural layer (audiovisual production).

Regarding creation, a first challenge that arises in these times of convergence of media platforms (Jenkins, 2006; Ponte, 2012) is the assurance of the quality of educational videos. Since the algorithms of digital streaming platforms do not prioritize good quality products over those most appealing or trending, it is necessary to ensure good quality content from the beginning of its creation. When pedagogical strategies and the possible side effects of inadequate products are disregarded, children learn nothing from videos and can also be exposed to harmful content. Therefore, researchers and producers must cooperate and work together to create pedagogically efficient products.

Some audiovisual content has been implicated in encouraging bad food choices, for instance, promoting poor nutrition and obesity and facilitating aggressive and antisocial behavior (Comstock & Scharrer, 2012). In addition, several studies have demonstrated that when viewers are systematically exposed to negative representations of gender and race or unrealistic ideals of beauty, this influences how they behave and act in the physical world (Messenger-Davies, 2010).

Notwithstanding, an important aspect to consider is that the same medium through which children can learn about a product in an advertisement can also make them learn scientific concepts through an educational program, for instance. Furthermore, the same medium that influences children to engage in aggressive behaviors after being exposed to a violent program also has the potential to influence them to behave cooperatively after watching prosocial programs (Fisch, 2004).

To transform good educational practices into efficient and engaging educational content, kindergarten teachers, researchers, and producers should collaborate to create evidence-based educational products (Fisch, 2017). These products can promote engagement and motivation. Consequently, they can promote learning while enhancing equal educational opportunities by making several educational resources available to a wide range of potential learners that otherwise could not access them, especially if distributed through digital media channels, such as video streaming platforms on the Internet.

Furthermore, it is necessary to acknowledge how to create engaging quality educational content than can compete with entertainment-only products, which are simultaneously available on streaming platforms. The primary motivation of most viewers is to be entertained, and this aspect is even more challenging regarding children and educational videos. For learning to occur, achieving focused attention, comprehension, and retention of the educational content is mandatory. Thus, it is necessary to retain the interest of the viewers besides attracting them, which can be a difficult task (Zillmann & Bryant, 2013).

In addition, it is paramount to provide media literacy to families and kindergarten teachers. By doing so, they can make an informed choice on what audiovisual products on digital platforms should be shown to their children since there is little (or none) human curatorship in determining what content to broadcast.

A second challenge that arises regards the production, since young children are still developing the perceptual and cognitive structures necessary for comprehending and learning from videos (Diergarten, Möckel, Nieding & Ohler, 2017). Therefore, it is necessary to acknowledge what production and editing strategies are indicated for educational videos for preschool children to produce effective and engaging products.

A third challenge that arises concerns distribution, since the recommendation and displaying of videos on digital platforms depend on the filtering of algorithms (Covington, Adams & Sargin, 2016). Addressing this challenge demands understanding how the algorithms of digital platforms work and identifying the dynamics of

consumption of the target audience, so that alternative distribution strategies can be designed to promote the visibility of the content.

The importance of producing good quality content for children, whether it is audiovisual content or content of other types, is a debate that has been gaining ground among scholars and producers in regions such as the United States, the United Kingdom, and Australia (Steemers, 2016).

Some authors have proposed guidelines for the production of such content, which comprise premises such as the importance of providing children with media content that entertains them, while fostering their physical, mental, and social development; allowing children to see, hear, and express themselves, their language and their culture, so that they can affirm their personal and cultural identity, and also appreciate other cultures and languages; avoiding the unnecessary presentation of violence, sex, and racism; communicating in a manner that is age-appropriate, child friendly, and not condescending; addressing the child holistically, being positive and strengths-based; relying on what is familiar, so that the content can bridge the new and unfamiliar for young children; ensuring the compatibility between verbal and visual components; being aesthetically attractive; including humor that does not entail the exploitation of others; promoting learning; fostering imagination and creativity; motivating children to produce and distribute their own content (see Lemish, 2020; Dias & Brito, 2018; POSCON, 2014).

Nonetheless, this topic is still considerably disregarded in the literature, evident in the scarcity of research on the effects of video screen media on the development of children and learning (Neumann & Herodotou, 2020). With this work, we intend to contribute to the study of this topic.

Structure of this work

On the following sections of this preliminary chapter dedicated to the introduction, we focus on the objectives of the work and on the research questions and the methods we used to address them.

Regarding the section dedicated to the [objectives](#), firstly, we provide a summary of the objectives of the entire work, and then we explain why and how we structure the following sections. We structured the chapters dedicated to the research questions and the literature review following four areas (discourse, design, production, and distribution), corresponding to the stages of conception of an audiovisual object (Kress & Leeuwen, 2001). In this section, we explain the objectives of each area.

In what regards to the section dedicated to the [research questions and the methods](#), we present the research questions and the empirical design.

Then, we divided this work into two parts, one dedicated to fundamental research and another to applied research. We begin by presenting the fundamental research part, named [Part I – Fundamental research](#).

We divided Part I into four chapters: Chapter 1 – Children in front of a screen: preliminary considerations on childhood and audiovisual media for children; Chapter 2 – A multimodal conception of an educational video: discourse, design, production, and distribution on digital platforms; and Chapter 3 – Research Design.

[Chapters 1](#) and [2](#) summarize the literature we reviewed to identify the challenges of digital platforms for creating, producing, and distributing educational videos, and to address our research questions. [Chapter 3](#) presents the studies we conducted for this work. We divided this chapter into six sections: the first five are dedicated to each study we conducted, and the last is dedicated to the general discussion.

[Part II](#) of this work presents the applied research project, an educational series about music education. This part describes how we applied the investigation results presented in Part I. To do so, we followed the same structure of the four areas of the Multimodal Theory of Communication of Kress & Leeuwen (2001), and divided [Chapter 4](#) into sections related to each area.

Finally, the last chapter of this work presents the [conclusions](#).

Brief summary of the work

The research we present in this work suggests that learning from educational videos is a demanding task for preschool children, due to the lack of maturation of several cognitive structures that are necessary for integrating and transferring the information of the video to the physical world, to their language comprehension skills that are still developing, to their short attention span and the small capacity of the working memory, and to the lack of relevance of the video as a reliable information source. Nonetheless, educational videos are a valuable education resource, and learning from them is possible despite the difficulties.

For overcoming these difficulties and maximizing learning from videos, we investigate the impact of the use of cognitive and pedagogical strategies in the production of educational videos, the impact of the screen size of the displaying device on the learning outcomes and engagement, the effect of cuts in editing and the use of closer and wider shots, and the differences between dubbed and not dubbed videos for learning.

In addition, considering the challenges that the algorithms pose for distributing educational videos on digital platforms, we investigate the dynamics of consumption of Portuguese families with preschool children regarding educational videos and related transmedia content. The objective of this investigation is to understand the digital behavior and preferences of the target audience of this type of audiovisual products to further design a complementary distribution strategy that can enhance the visibility of the content.

Starting from the results of our research, in this work we suggest strategies for creators and producers to adopt to maximize the efficiency, engagement, and visibility of their products. Furthermore, we present how we applied the results of our research into the creation and production of an educational video for preschool children about music education.

1. OBJECTIVES OF THE WORK

The objectives of this work were (1) to identify the challenges that digital platforms represent for the creation, production, and distribution of educational videos for preschool children; (2) to investigate, from the perspective of a producer, how to address these challenges and how to create, produce, and distribute effective, adequate, and engaging educational videos for preschool children (3-5 years old); and (3) to apply the preliminary research in the creation and distribution on YouTube of a pilot episode of an educational series about music. Therefore, this work is divided into two parts, namely one of fundamental research and another of applied research.

In what concerns the fundamental research, we aimed to address the following main research questions, further explained and developed in the next section of the work:

(RQ1) *How do children learn from educational videos?*

(RQ2) *What should be the characteristics of educational videos for preschool children?*

(RQ3) *What are the production and editing strategies that make an engaging and effective educational video for preschool children?*

(RQ4) *What are the challenges of digital platforms for distributing educational videos, and how can producers address them?*

(RQ5) *What are the dynamics of Portuguese families in consuming educational videos and related transmedia content?*

Regarding the applied research, we intended to create, produce, and design the distribution strategy for the pilot episode of an educational series targeted at Portuguese preschool children (3-5 years old) that met the insights gathered in the preliminary research. The series we created is titled *Lara no País da Música (Lara in Musicland)* and is a four-episode series about music education. Through this object, we aim to convey the four properties of sound, namely intensity, timbre, pitch, and duration.

The title of the audiovisual series came from a project of original songs for children that we created and distributed on YouTube between the end of 2018 and 2021. We created this musical project before the series to introduce Lara and Leo, the main characters, to potential audiences and pave the way for the educational series that is intended to be the main product of the YouTube channel. Besides this channel, the project has a website and a Facebook page.

Regarding the educational audiovisual series, we chose the topic of music education considering that this subject can be fundamental for developing several social and cognitive skills throughout childhood. As the literature suggests, music education can contribute to developing language, empathy, to the improvement of attention span, memory, social skills, and integration, among others (e.g., Ehrlin & Gustavsson, 2015; Hyde et al., 2009; Patel & Iversen, 2007; Strickland, 2012; Turner, 2018; Walton, 2014; Wiggins, 2007). Nonetheless, most kindergartens in Portugal only offer music education as a spare time activity, with extra costs for the parents, and therefore it is still considered a privilege for many children. This inequality in educational opportunities can be minimized with the use of educational videos distributed through digital platforms.

Although educational videos are often developed as a tool for formal education, informal education (i.e., education without a school curriculum) is often the purpose of several educational objects (Kirkorian & Anderson, 2008). Regarding preschool children, educational videos can prepare for school readiness (as in *Sesame Street*, for instance), problem-solving, and literacy skills (Linebarger & Piotrowski, 2010). Furthermore, educational videos can introduce subjects that can be further developed in later life, such as music education or foreign languages, contributing to the cognitive development of children.

The choice over the target audience of preschool children (3-5 years old) was made considering firstly the importance of segmenting the target audience when creating an audiovisual product, since the characteristics and the expectations of the audience differ considerably between its segments (Bell, 1984; Lozano, 2017). Furthermore, two factors were considered: readiness for learning from audiovisual media and cognitive development.

Around 6 years old, most children enroll in primary school, which means that several changes in this period influence their skills. To begin with, at around this age, children are already abandoning the preoperational stage, as defined by Jean Piaget (1971), to enter the concrete operational stage, in which they abandon the egocentrism that exists in the previous stage and begin to develop logical reasoning. This change between stages has implications for several aspects of how children perceive the world and how they interact with it. Thus, audiovisual content aimed at younger children should be different from those targeted at children from 6 years old.

Areas of this work

As mentioned previously, this work is divided into two parts: one of fundamental research and another of applied research.

Regarding the fundamental research part, we divided the sections dedicated to the research questions and the literature review (State of the Art) into four areas, following the four stages (*strata*) of the conception of a semiotic object suggested in the Multimodal Theory of Communication by Kress and Leeuwen (2001).

In what concerns the applied research part, we divided it into the same four areas, each corresponding to one of the four stages of conception of the audiovisual product we created.

The four areas are the following: (i) the discourse, which refers to the social construct of an aspect of reality, depending on the cultural context in which it is conceived and interpreted; (ii) the design, which is the conceptualization of the form of the semiotic product; (iii) the production, which is the materialization of the design through the articulation of different semiotic modes; and (iv) the distribution, which refers to the reproduction technologies that are used to distribute the audiovisual content (Kress & Leeuwen, 2001). The applied research part of this work follows the same organization.

The Multimodal Theory of Communication posits that contemporary communication is based on a multimodal semiotic system, which is associated with

interdisciplinarity and complementarity between modes and media. Regardless of the semiotic system that is used (linguistic, visual, audio, gestural, and spatial) or how different modes and systems are combined (such as the articulation between image and sound in film, for instance), the conception of every object encompasses the areas mentioned above (Kress & Leeuwen, 2001).

Objectives of each area

Regarding the first area, the discourse, we intended to investigate how preschool children learn from educational videos. Thus, we focused our research on the weight of cognitive and pedagogical production strategies for learning from educational videos.

In what concerns the second area, the design, we intended to systematize the features that educational videos should have to be effective, adequate, and engaging for Portuguese preschool children (3-5 years old). To do so, we focused our research on the following: (1) definition of the formal characteristics of the episodes (format and editing pace), (2) design of the characters and of their socio-cultural contexts and their interactions, (3) definition of the language and communication strategies to be used on the script, and (4) selection of the educational content to be covered and good teaching practices to be transferred into video format.

Considering the third area, the production, we intended to investigate the adequate production and editing techniques and strategies to achieve an engaging and effective audiovisual product for preschool children. Thus, our investigation focused on the following: (1) how engagement and learning outcomes vary between different screen sizes, (2) if the effectiveness of educational videos is affected by using continuity editing, and (3) how effectiveness varies between dubbed and not dubbed videos in what regards the learning outcomes.

Finally, regarding the fourth area, the distribution, we intended to investigate the challenges that digital platforms pose for distributing educational videos and understand how producers can address them. In addition, we aimed to investigate the

preferred channels and platforms for Portuguese families to consume educational videos and if and where they consume transmedia content related to this type of educational media.

In the following section, we detail the research questions of the work, and we explain how we addressed them.

2. METHODS: RESEARCH QUESTIONS AND EMPIRICAL DESIGN

As previously mentioned, we investigated the challenges digital platforms pose for creating, producing, and distributing educational videos and the forms of addressing them in four areas: discourse, design, production, and distribution. For this research, we reviewed literature and conducted five studies.

The literature review process was conducted between June of 2019 and December of 2021 in databases such as Science Direct, b-on, and Education Source. Additionally, more searches were run using Google Scholar. The following keywords were searched: educational videos, educational media, audiovisual media and learning, educational videos for pre-school children, YouTube and preschool children, digital media and child development, among others. Considering that digital media is somehow a recent topic in the literature, the literature review process had two phases: in the first phase, the limits were set to articles and book chapters published from 2010 onwards, focusing on educational content and digital platforms. In the second phase, the limits were set to articles and book chapters published from 2000 onwards, to search for ground literature on educational videos and television.

Regarding the area of discourse, a challenge we identified in the literature was that the algorithms that recommend videos do not necessarily select what is of pedagogical quality, prioritizing the content that is statistically more likely to be enjoyed by the viewer, regardless of its quality (Covington, Adams & Sargin, 2016).

As a strategy for addressing this challenge, from the perspective of an audiovisual producer, it is important to acknowledge how to create pedagogically effective and appealing products that compete with the entertainment content available on digital platforms. Therefore, we started with the following research question: (RQ1) *How do children learn from educational videos?*

Furthermore, to address the challenge mentioned above, families and kindergarten teachers must assess the quality of the educational videos before displaying them to the children, mediating the recommendation of the algorithms. This mediation can start by identifying critical video features fundamental for learning.

Bearing this in mind, starting from the literature review, we created an assessment tool of educational videos for preschool children named EVAT – Educational Videos Assessment Tool, targeted at families and kindergarten teachers. Producers can also use this tool to assess the quality of their products.

After creating the EVAT tool, we conducted an empirical study with Portuguese preschool children to investigate the importance and the weight of cognitive and pedagogical strategies for learning from educational videos (Study 1). To do so, we formulated the following research question: (RQ1.1) *Is learning from educational videos dependent on the use of cognitive and pedagogical strategies in their production?*

For answering this research question, we measured the learning outcomes from four different video stimuli: a video with cognitive and pedagogical strategies; a video with cognitive strategies only; a video with pedagogical strategies only; and a video without cognitive or pedagogical strategies. We displayed the four video stimuli on the same device (a laptop) and adopted a procedure that aimed to assess learning on the second level of the Learning Taxonomy of Bloom by assessing the further identification of an object displayed on the video (a musical instrument).

Regarding the area of design, we systematized the adequate features for pedagogically efficient and engaging educational videos from the literature review. For this systematization, we started with the research question: (RQ2) *What should be the characteristics of educational videos for preschool children?*

Then, we divided RQ2 into four topics and reviewed the literature to address the following research questions:

(RQ2.1) *What should be the formal features of the episodes – format (animation or live-action) and editing pace?*

(RQ2.2) *How should be the characters and their sociocultural contexts?*

(RQ2.3) *What language and communication strategies are adequate and engaging for preschool children?*

(RQ2.4) *What good practices in music education can be transferred to video?*

In what concerns the area of production, we began by investigating recommended strategies in the literature for producing effective and engaging educational videos for preschool children. We started with the following research question: (RQ3) *What are the production and editing strategies that make an engaging and effective educational video for preschool children?* We addressed this question with a literature review, followed by an empirical study.

From the perspective of an audiovisual producer, a challenge we identified in the literature refers to the intelligibility of the videos, i.e., the good quality of image and sound that promotes learning (Lange & Costley, 2020). Since users often consume videos on small or medium screen size devices (smartphones and tablets) with low sound quality, the intelligibility of the videos can become compromised. Considering that the cognitive structures of young children are still developing, which is already challenging to learn from videos, small image sizes with poor sound quality can jeopardize the learning experience. Furthermore, the literature suggests that using different devices results in different engagement levels with the content (Noorhidawati, Ghalebadi & Hajar, 2015; Roskos, Burstein, Shang & Gray, 2014).

Therefore, to investigate if the consumption device influences the learning experience from videos in preschool children, we conducted a second study with Portuguese children (Study 2). This study aimed to investigate if the displaying devices influence engagement and the learning outcomes from educational videos. To do so, we started with a research question that derived from RQ3, namely: (RQ3.1) *Do engagement and the learning outcomes from educational videos vary according to the screen size of the displaying devices?*

Regarding the methodology for this study, we displayed the same video stimulus to the participants (a video with cognitive and pedagogical strategies) on different devices (a smartphone, a tablet, and a laptop). We measured the learning outcomes by asking for the identification of an object displayed on the video (a musical instrument) and measured the engagement by registering the salient behaviors of the children that showed they were having an engaging learning experience.

Furthermore, still regarding intelligibility, we identified in the literature another challenge for the production that concerns the editing strategies and the shot types used in educational videos. Since the working memory and visual perception abilities of younger children are still developing, as well as their media sign literacy, editing with different shot types and sizes can undermine learning from videos. Bearing this in mind, we investigated if this challenge jeopardizes learning in preschool children.

Thus, we conducted a third study with Portuguese preschool children (Study 3). This study investigated if editing with different shot sizes leads to poorer learning outcomes than not edited videos (continuous shot). We started with the research question (RQ3.2) *Is the effectiveness of educational videos affected by using continuity editing?*

Regarding the methodology for this study, we used two different video stimuli with the participants. Starting from the same video with cognitive and pedagogical strategies, we edited one version using cuts and combining different shots, and another version was not edited (using a continuous shot). Both versions of the video were displayed on a laptop. We measured the learning outcomes by asking the children to identify an object displayed on the video (a musical instrument).

Still regarding the production area, in what concerns congruence, i.e., the need to articulate the visual and sound source of the video (Lange & Costley, 2020), we identified a challenge referring to dubbed content since the visual information does not correspond to the sound and this lack of synchronicity can jeopardize learning. To investigate if this aspect can compromise learning in preschool children, we conducted a fourth study with Portuguese children (Study 4). This study aimed to investigate if dubbing negatively affects learning from videos compared to the original version and if using closer shots increases the negative impact since the lip movements are more clearly seen. To do so, we started with the research question (RQ3.3) *Are dubbed educational videos as effective as not dubbed educational videos?*

In what concerns the methodology for this study, we displayed three different video stimuli to the participants on the same device (a laptop). Starting from a video with cognitive and pedagogical strategies, one of the video stimuli was the original

version (in Portuguese), another was dubbed from English into Portuguese, and another was dubbed in Portuguese and edited with different shot types (close and wide shots). The learning outcomes were measured by asking the children to identify an object displayed on the video (a musical instrument).

Finally, regarding the distribution, we started from the (RQ4) *What are the challenges of digital platforms for distributing educational videos, and how can producers address them?* We addressed this research question with a literature review.

In the literature, we identified a challenge in the perspective of the producer/distributor, referring to how the algorithms of the platforms filter and recommend content. This filtering negatively affects the visibility of content distributed by independent producers (McKelvey & Hunt, 2019), and the strategy for addressing this challenge encompasses the need to adopt complementary forms of distribution that reinforce the digital presence of the content (Mazzoli, 2020).

Bearing this in mind, we conducted an exploratory study with Portuguese families with preschool children to investigate the dynamics of consumption and transmedia content preferences (Study 5). This study started from the research question (RQ5) *What are the dynamics of Portuguese families in consuming educational videos and related transmedia content?* Regarding the methodology, we distributed a survey to Portuguese families in the Lisbon area and Torres Vedras and analyzed the results.

Table 1 summarizes the areas in which we divided this work, the research questions related to each area, and the methodological approach we applied for each question. As previously mentioned, this work has a fundamental research part and a part of applied research. The same research questions were used for guiding both parts since the results of the fundamental research part were applied in creating a pilot episode of an educational series about music education, as further explained in the applied research part.

TABLE 1			
Area		Research Question	Method
Discourse	RQ1	How do children learn from educational videos?	Literature review
	RQ1.1	Is learning from educational videos dependent on the use of cognitive and pedagogical strategies in their production?	Study 1
Design	RQ2	What should be the characteristics of educational videos for preschool children?	Literature review
	RQ2.1	What should be the formal features of the episodes – format (animation or live-action) and editing pace?	Literature review
	RQ2.2	How should be the characters and their sociocultural contexts?	Literature review
	RQ2.3	What language and communication strategies are adequate and engaging for preschool children?	Literature review
	RQ2.4	What good practices in music education can be transferred to video?	Literature review
Production	RQ3	What are the production and editing strategies that make an engaging and effective educational video for preschool children?	Literature review
	RQ3.1	Do engagement and the learning outcomes from educational videos vary according to the screen size of the displaying devices?	Study 2
	RQ3.2	Is the effectiveness of educational videos affected by using continuity editing?	Study 3
	RQ3.3	Are dubbed educational videos as effective as not dubbed educational videos?	Study 4
Distribution	RQ4	What are the challenges of digital platforms for distributing educational videos, and how can producers address them?	Literature review
	RQ5	What are the dynamics of Portuguese families in consuming educational videos and related transmedia content?	Study 5

Table 1 – Areas, research questions, and methodology of this work (source: the author)

PART I

FUNDAMENTAL RESEARCH

CHAPTER 1 – CHILDREN IN FRONT OF A SCREEN: PRELIMINARY CONSIDERATIONS ON CHILDHOOD AND AUDIOVISUAL MEDIA FOR CHILDREN

This chapter presents an introductory framework of the relationship between children and audiovisual media. We begin by explaining the specificities of children as a target audience. Then, we present the history of audiovisual programs for children. Finally, we detail how digital media are changing the media landscape and the habits of children in consuming audiovisual content.

We consider these preliminary considerations fundamental for understanding how children perceive the content targeted at them, their preferences, and their expectations towards it. In addition, this chapter intends to describe the evolution of educational programs throughout the history of audiovisual media for children to explain how commercial circuits impact the production of good quality and cultural-specific content. Finally, we present how digital platforms are changing the dynamics of consumption of audiovisual content and the implications this change can represent for creators and producers.

What is means to be a child: the specificities of children as a target audience

Childhood cannot be defined only biologically, since it is the result of historical and social circumstances as well, and how each society defines the role of childhood is fundamental for the development of the role of children as social actors (Leitão, 2008). Similarly, how the audiovisual industry perceives what it means to be a child as a target audience determines what resources such as time, space, and financial investment are allocated to content targeted at children (Potter & Steemers, 2020).

The concept of childhood is a cultural construct, i.e., something that reflects the socio, moral, and political concerns of a given time and place rather than a biological circumstance (Messenger-Davies, 2010). In the Western pre-industrial societies, for

instance, children were involved in the dynamics of economic survival of the families and were perceived as one more element of the family, far from the image of innocence, purity, and need for protection that they have in those societies nowadays. Within the Western post-industrial context, cultural products targeted at children emerged, arising from a shift in the collective perception of what is childhood. That emergence was facilitated by social and economic changes, along with technological innovation (Parry, 2013).

Even though the contrasts in how different societies perceive childhood should not be neglected (e.g., the contrasting role of children in the United Kingdom and Peru), the biological development of children should be considered in order to evaluate the interaction between biology and educational inputs (Leitão, 2008). The literature suggests that children are a particular type of audience, different from adults, since their little knowledge contrasts with their immense curiosity. If the scarcity of knowledge may affect the comprehension of content (especially the lack of ability to distinguish reality from fiction), their will to learn makes them particularly open to the influence of the medium. From a semiotic perspective, the meaning-making process of the same message is not equal in a preschool child or an adolescent, since their cognitive abilities are in different stages of development. Therefore, age is an important variable to consider when conducting research on children as a type of audience (Ponte, 1998).

Studies have demonstrated that younger children tend to focus on what is immediate, having the ability to see the world full of fantasy and magic. From seven or eight years old, there is a transformation towards rationalization, and more realistic genres tend to be preferred. Even though children recognize the importance of magic, including special effects that are used in programs targeted at them, they perceive it as important only for younger children (Leitão, 2008).

Gender also influences the preferences of the viewers, since studies conducted among American children have demonstrated that boys preferred to watch westerns and adventure series while girls preferred to watch musicals and sitcoms (Ponte, 1998). Nevertheless, it should be borne in mind that there is a historical bias in what regards the assessment of gender preferences: there is a tendency for the

masculinization of the broadcast programming, and it is commonly assumed that girls watch programs that are targeted at boys, but the opposite does not occur (Leitão, 2008).

Research also suggests that the expectations and motivations, as well as the context in which children watch videos, play an important role in their preferences and meaning-making processes. Regarding television, studies have shown that children who perceive it as an informative medium are more willing to infer meaning than those who perceive it as merely entertaining. Furthermore, it has been suggested that most television experience among younger children is within a familiar context. Therefore, it is dependent on family routines and the habits and interests of consumption of older members (Ponte, 1998). The same dependence on the choice of parents and other caregivers can be noticed in what concerns digital media since it is usually adults who choose what content young children should watch or what mobile applications they should use (Steemers, 2011).

How programs for children have changed since they were first broadcasted

The history of programs for children is strongly related to how societies perceive childhood and audiovisual media. The differences in the perception of these two elements have influenced the production, distribution, funding, and revenue models of educational audiovisual media since its beginnings.

In the United Kingdom, for instance, television was seen as a public good after the Second World War, and children were seen as young citizens for whom appropriate content should be provided, aiming to contribute to their development. Within this context, the first programs targeted at preschool children emerged in the BBC by the beginning of the decade of 1950, being publicly funded (Potter & Steemers, 2020). Such programs were intended to facilitate the relationships between mothers and their children through joint viewing rather than representing this target audience as a specific market segment (Steemers, 2011).

Conversely to this perception of children as citizens in the making, in the United States they tend to be considered mostly as consumers of merchandise and advertising, and the production of programs targeted at them has traditionally depended on commercial interests. Since there is no tradition of public-funded media, television has been highly commercialized since its beginnings, and products targeted at children have not been an exception (Potter & Steemers, 2020).

Similar to the European timeline, it was also in the decade of 1950 that North American broadcast companies began to produce content targeted at children of all ages. Most of these programs were filmed indoors, at the studio, at a slow pace, welcoming the participation of the viewers. In the decade of 1960, the market-based logic began to lead the broadcast programming due to the interest in the advertising of emergent industries of products aimed at children. Given the fast rotation of the audiences, the programs were systematically repeated. In addition, comics from the decades of 1930 and 1940 were adapted into television, such as *Spider Man*, *Batman*, and *Superman*. In 1968, the “Action for Children’s Television” gained the support of the Federal Communications Commission, that restrained advertising and promoted the emergence of quality educational programs with diversified content, and many literary works were adapted into series for children. As a result, the pace of the programs slowed, and the series became more realistic and gained human presence, which demanded more expensive budgets (Ponte 2012; 1998).

Within this context, preschool children were considered a non-profit target audience. Thus, the programs aimed at them were essentially educational, with no revenue-driven orientation. This lack of a revenue model significantly limited the interest in their production since the broadcasters preferred profitable programs (Steemers, 2011).

Between 1949 and 1979, the production of content for children was undervalued in Europe. The programs that were broadcasted varied between travel and adventure, among others. By the end of the decade of 1970, due to a decline in the interest in expensive productions, the most broadcasted content was coproduced series between Japan and some European countries, which recovered classics from children’s literature, such as *Maya the Bee* and *Heidi* (Germany), *Ulysses 31*, *Pinnocchio*,

Tom Sawyer, and *Huckleberry Finn* (France). Since these were 52-episode series of 26 minutes each, this strategy ensured that they would be broadcasted for one year, retaining audiences and giving visibility to related merchandising products (Ponte, 2012).

By the beginning of the decade of 1980, the broadcast via satellite, the emergence of a multiplicity of channels, the remote control, home video systems, and a sharp increase in the number of hours of broadcasting marked the beginning of a new period. In this period, the American commercial model of television reached Europe. Liberal politics favored the constitution of powerful international financial groups with multimedia strategies, which promoted the convergence of different platforms, such as the digital recording industry, cinema, and television. In the United States of America, as a consequence of the shortage of supply in production by the end of the decade of 1970, at the beginning of this new period, the producing companies began to offer turnkey programs to television broadcasters in exchange for commercial time for advertising. Thus, at the beginning of the decade of 1980, non-fictional programs, as well as educative or informative programs, which offered fewer possibilities for promotion of merchandising products, were replaced by animated cartoons of adventure and action (Ponte, 2012).

In what concerns Europe, on the program schedule of European channels, there could be noticed a combination of the pedagogic and cultural ideal of each country with the new trends that were arriving from North America and Japan. In the United Kingdom, the genre of “marvelous” was dominant in the broadcasted programs for children; in France, the pedagogic aspect was considered the most important; in the Nordic countries, the programs approached contemporary family issues, such as divorce. The diversity contrasted with the characteristics of Japanese and North American cartoons, which emphasized fear and a fast pace (Ponte, 2012).

In the decade of 1990, cable television made available channels for children such as Nickelodeon (Viacom), Disney, and Cartoon Network (Time Warner), family-oriented networks, and music channels that children attended (Comstock & Scharrer, 2012). These channels expanded worldwide, benefiting from favorable conditions from regulators and the technological progress that gave them direct access to audiences. In

many European countries, there was a release of “local adaptations” of programs with cultural specificities, namely in the use of the national language (Ponte, 2012).

At that time, the perception of the preschool audience as of little commercial value changed in the United States. With the emergence of multichannel cable television, not only the broadcasters began to dedicate channels and blocks to children but also to recognize the value of separating the preschool audience from older children. This separation permitted to explore the needs of this specific audience and its potential regarding the markets of home entertainment and consumer products, both internally and abroad (Steemers, 2011).

Regarding Portugal, until the end of the decade of 1960, programs targeted at children varied between films, circuses, storytelling, theater plays, fictional series (such as *Lassie* and *Zorro*), and North American cartoons (such as *The Flintstones*, *Bugs Bunny*, and *Popeye*). Between 1969 and 1973, a team directed by Maria do Sameiro Souto tried to renovate the broadcast programming. However, modernization collided with the lack of technical language knowledge and the censorship to which all the content was subject (Ponte, 2012).

Between 1974 and 1987, broadcast programming had a low budget. Nonetheless, it remains in the memory of those who watched the programs. Between 1987 and 1991, sponsorships and advertising spots increased, dominated by Disney. In addition, programs such as *Sesame Street*, targeting preschool children, were adapted to the Portuguese language and culture (Ponte, 2012).

Between 1992 and 2002, there was a reduction in formats and genres. Following the European trends, the most broadcasted programs were cartoons imported from North America and Japan. In addition, there was a decline in European production and the number of programs made by Portuguese producers (Pereira, 2007).

Throughout the decade of 2000, even though fiction and animation were the most broadcasted formats, there was considerable diversity within the genres and the themes that the stories covered. The programs combined educational aspects and

current concerns, thus challenging the traditional dichotomy of education versus entertainment (Ponte, 2012).

Nonetheless, the emergence of OTT (over-the-top) Internet services and an increasing transnational content offering on cable channels significantly reduced the interest in local productions, which have often been set aside since then (Potter & Steemers, 2017).

Considering the history of programs for children, research suggests that the variation in the format and the pace of the most broadcasted content is historically related to commercial interests and budgetary restrictions. The reviewed literature points out that the most produced and broadcasted format has been animation, and the one which is more dependent on budget availability is educational programs with human presence in live-action (real image), which has been systematically facing difficulties both in funding and in sustainability (see Potter & Steemers, 2020).

Nonetheless, despite the popularity of the animation format and its profitability, research on programs for children has demonstrated that it conventionally presents fewer dialogues scenes, higher levels of action, rapid pace, cuts, fades, zooms, special visual effects, vocalizations, special sound effects, and rapid music, which are not necessarily the adequate features for children.

Educational programs, in turn, tend to consider cultural specificities and the age of the target audience in the construction of the linguistic codes that they present. For preschool children, verbal communication is usually presented at a medium level of difficulty, using literal statements and the reinforcement of keywords. In contrast, programs targeted at older children presented a higher language level in the dialogues, aiming to enrich vocabulary, and presented non-literal meanings with simple grammar structures and short sentences (Ponte, 1998). As mentioned previously in this work, it is necessary to consider the importance of providing children good quality products aimed at them, and to find new ways of ensuring the survival of the production of local content for children within the new media landscape.

New screens, new habits: how digital media are changing the way children watch audiovisual products

The emergence of digital media caused profound changes in the media landscape, inducing a shift from communication processes that were traditionally unidirectional to significant user interaction with the media. The new media landscape is characterized by the individual ownership of multiple communication devices, such as television and computers; by the diversity, flexibility, and combination of formats and content from different media; by the tendency for globalization and individualization of lifestyle; by the convergence of media; and by the tendency for media democratization within the families. On the Internet, the audiences can interact in real time, produce and distribute content, and explore new ways of communicating online (Ponte, 2012).

Within this context, both commercially funded broadcasting companies and producers can generate revenue from websites by selling advertising space, subscriptions, or merchandising products (Steemers, 2011). Nonetheless, the digital shift means much more than investing in a domain or a website, and while the broadcasters initially perceived the Internet as a vast place for testing new ideas, nowadays, it represents a challenge for the survival of the traditional model of broadcasting. Therefore, broadcasters need to decide about new strategies for distributing their content online. These strategies encompass the reallocation of resources and are paramount for determining the sustainability of the professional production of content for children (Potter & Steemers, 2020).

The literature suggests that the more recent generation of children – generation Z, born between 2000 and 2010, and generation Alpha, born after 2010 – have in common being growing up in a globalized world and immersed in screens and technology. Many children, even before speaking, already know how to use tablets and smartphones, thus being named “digital natives” or “generation thumb”, since they are surrounded by diverse platforms competing for their attention. Digital media is a field that encompasses multiple utilities, a world full of stimuli with no physical or time restrictions, and that expands reality and the existence itself. Consequently,

children may develop more open minds oriented toward the global dimension. These children do not distinguish between the physical and virtual worlds since they overlap activities, experiences, spaces, and times of social interaction. Moreover, the permanent flood of information and the rapid pace are changing the perception of time in children. Children are getting used to having the information as rapidly as they click on a link on digital platforms. Their need for an immediate response makes them more demanding for urgency, which is why the smartphone is increasingly replacing the computer. They devote little time to deep thinking about a matter and are constantly hopping mentally. Thus, it is time to stop thinking about producing content for television only and begin widening the perspective into an ecosystem of content that must be available on all the platforms and be easily accessed (Basílio, 2018).

Bearing the abovementioned issues in mind, some broadcasters are now releasing on-demand services, intending to keep pace with the several OTT (over-the-top) services that are being systematically released on the Internet, which are gaining more and more viewers every day.

The prominent role of YouTube within digital streaming platforms

One of the most important OTT services is YouTube. This SVOD/AVOD (subscription/advertising-based video-on-demand) service was introduced in 2005 and is now one of the direct competitors of traditional broadcasters, having generated several alternative content providers since its emergence (Potter & Steemers, 2020). Besides presenting a comprehensive collection of videos, the success of YouTube is also due to its diverse discovery mechanisms, such as video recommendation and highlights, a keyword-based search engine, channel subscription, and the possibility of embedding content on social networks, blogs, and web pages (Zhou, Khemmarat, Gao, Wan & Zhang, 2016).

Children use YouTube massively, and recent studies demonstrate that popular channels targeting young children include nursery rhymes, gaming, and toy unboxing (Potter & Steemers, 2020). Most parents regard this digital platform as an important tool for learning songs, rhymes, words, and setting sleep routines, and use it as a

parenting tool for entertainment and behavioral control. During the pandemic of COVID-19, in Occidental European countries such as Germany, France, Spain, Italy, and the United Kingdom, there was a noteworthy increase in the number of channels dedicated to the entertainment of children, which affirms the rising importance of YouTube among this target audience. Nonetheless, the same trend did not exist in educational channels: only in Germany and Italy the number of educational channels increased (Lozano-Blasco, Quilez-Robres, Delgado-Bujedo & Latorre-Martínez, 2021).

Aware of the importance of children as a target audience, in 2015, YouTube launched a platform directly aimed at them, the YouTube Kids, which is available both as a website and a mobile application (Potter & Steemers, 2020). YouTube Kids aims to promote a safe exploration of the world through videos in a safe and controlled environment. To achieve this mission, the application includes a feature of parental control and search algorithms that filter the videos according to the age of the children and other metadata such as search and viewing history. Reports provided by analytic companies (Apptopia and Braze) demonstrated that on a global level, YouTube Kids was the most-watched platform in the first three months of 2020, even more than Netflix, Amazon Prime Video, and Disney (Temban, Hua & Said, 2021; Rasool, 2020).

On YouTube and YouTube Kids, children can rapidly switch the video they are watching, selecting another one among an immensely vast available content. Within this context, it is now more difficult for producers and distributors to build an audience sufficiently broad to achieve a revenue model based on licensed merchandise and sustain new programs for children (Potter & Steemers, 2020).

Furthermore, the displaying of content is dependent on the filtering of algorithms that compromise the visibility of the products. As these algorithms select the content that is probable to be enjoyed by the viewer, rather than what is pedagogically adequate, regarding educational videos for children, it is essential to understand what strategies in the production and distribution can attract and retain this type of audience with appealing, engaging, and effective products. In addition, it is paramount to consider what pedagogical and cognitive strategies can foster learning to sustain an offer that is a reliable learning source and that is adequate for young viewers.

CHAPTER 2 – A MULTIMODAL CONCEPTION OF AN EDUCATIONAL VIDEO: DISCOURSE, DESIGN, PRODUCTION, AND DISTRIBUTION ON DIGITAL PLATFORMS

As mentioned in the Introduction, this work had the objective of identifying and addressing the challenges of creating and distributing educational videos for preschool children on digital platforms. Thus, we aimed to systematize and investigate how to create, produce, and distribute effective, adequate, and engaging educational videos for preschool children (3-5 years old) and to apply this research in the creation, production, and distribution of a pilot episode for an educational series about music education.

Considering these objectives, we divided the literature review into four parts that correspond to the four stages of conception of an audiovisual object, namely (i) the discourse, (ii) the design, (iii) the production, and (iv) the distribution. As explained previously, these areas derive from adapting the four stages suggested in the Multimodality Theory of Communication by Kress and Leeuwen (2001). Each area is subdivided into topics related to it.

2.1. THE DISCOURSE

In this first area, we intended to understand how children learn from educational videos, starting from a theoretical framework on how learning occurs in general and then focusing on how it occurs through educational products.

Hence, we divided this area into six topics:

- Understanding how children develop and learn: insights from child development theories and neuropsychological foundations for learning
- Cognitive factors that influence learning: comprehension, emotion, motivation, attention, and repetition
- Why different types of learning result in different learning outcomes

- Learning from educational videos: overcoming the video deficit and beyond
- The role of engagement in learning from educational videos
- The role of families and kindergarten teacher in learning from educational videos.

Understanding how children develop and learn: insights from child development theories and neuropsychological foundations for learning

Even though the concept of childhood is a social construct, knowing how children develop both biological and psychologically is paramount to creating age-appropriate content. It is important to know when a child is ready to engage in a task and comprehend it so that the activities and products that families and kindergarten teachers present to them can be effective in what regards skill acquisition and development towards a following stage.

The developing child and the development of audiovisual media literacy and competence

Several findings in the field of Psychology have been crucial to understanding how development and learning occur in childhood, such as the Theory of Cognitive Development of Jean Piaget (1971), which claims that children develop cognitively throughout four stages, namely: the sensorimotor stage, between infancy and 2 years old; the preoperational stage, between 2 and 7 years old; the concrete operational stage, between 7 and 11 years old, and the formal operational stage, from 11 years old. Each stage has different characteristics.

Firstly, in the sensorimotor stage (0-2 years old), there is an increase in verbal and motoric abilities, and the major milestone for development is the achievement of the understanding that an object still exists when it is out of the sight of children (object permanence) (Pietschmann, Völkel & Ohler, 2014). When this is accomplished,

children pass to the pre-operational stage (2-7 years old), in which there can be noticed an egocentric way of thinking that relies on the assumption that all the people see the world and feel the same way they do. In addition, contrasting with the previous stage, children can already engage in symbolic forms of playing, such as pretending. When children abandon egocentrism, they enter the concrete operational stage (7-11 years old), where they begin to develop logical reasoning regarding physical objects. Finally, at about 11-12 years old, children enter the formal operational stage, in which they can think abstractly and begin to formulate hypotheses (Piaget, 1971).

While Piaget states that cognitive development is a natural process, independent of the sociocultural context of children, Lev Vygotsky, in the Social Development Theory, posits that the social environment and interactions are fundamental for development. According to Vygotsky, children develop within a “zone of proximal development,” which refers to the difference between what the children can already do independently (their current skill level) and what they can reach when guided by adults or capable peers (Richards & Calvert, 2017; Vygotsky & Cole, 1981).

Similarly, Albert Bandura developed the Social Learning Theory (or Social Cognitive Theory), which claims that children learn by observing how humans around them behave and interact with the environment, and by modeling their behavior and interactions. From his research, Bandura concluded that children mimic the behavior of others (adults and peers), whether it is aggressive or non-aggressive. Thus, behavior can be learned and changed by observing behavioral models. Considering these findings, the Social Learning Theory posits three types of modeling stimuli: live models, verbal instruction, and symbolic models. Regarding the latter type, the modeling comes from the media, in which the characters can be real or fictional (Bandura, 1965; 2009).

Audiovisual media for children can be a powerful tool for social development since the characters can model appropriate behavior and social interactions and conversations. This modeling can also enhance language development and emotional competence (Linebarger, Brey, Fenstermacher & Barr, 2017; Rasmussen et al., 2018). Nonetheless, if the characters model inappropriate, violent, and aggressive behavior,

this too can change how children behave. Repeated exposure to audiovisual content influences the behavior of younger viewers, especially if the characters are realistic, similar to the child in what concerns age and gender, if they receive positive reinforcement, and the act can be mimicked by the child (Neumann & Herodotou, 2020).

Within this scope, the Cultivation Theory posits that the depiction of reality made by audiovisual media shapes and shifts the perception of the viewers, even if this depiction is neither precise nor accurate. According to this theory, how people and social relationships are portrayed in the media influences the perception of children about the world (Gerbner et al. 2002; Neumann & Herodotou, 2020). Thus, it is fundamental to present socioculturally representative characters to avoid a biased perception of reality and minimize stereotypes. This topic will be further developed in this chapter (please see “The Design”).

In what regards to the development of audiovisual media literacy and competence, drawing upon the Representation Levels of Perner (1993) and the Model of Development of Media Literacy of Potter (2013), some authors suggest that between 18 and 24 months, children can already understand two-dimensional symbolic representations such as drawings and pictures on books and television. Nonetheless, even though they can distinguish between some fictional and non-fictional narratives, they are not able to understand complex narrative structures yet (Pietschmann, Völkel & Ohler, 2014).

At about 3 years old, children can cognitively process film elements such as color, music, sound effects, and motion, but they cannot understand the motives and intentions of the characters due to the lack of metarepresentation skills, i.e., the skills that allow them to understand the perspectives of others. Therefore, it is not before the age of 4 years old that children can concentrate on storylines and comprehend them. Furthermore, children under 4 years old are not yet able to understand changes in the size and form of an object depending on the distance and viewpoint (visual perspective), which limits the comprehension of the narrative when using different shot types (this topic will be further developed in this chapter – please see “The Production”). Between 5 and 9 years old, after acquiring fundamental skills such as

time sequencing and motive-action consequence, children become aware of liking and disliking characters and shows. From 9 years old, children become interested in certain topics, and become more critical in content and aesthetics (Pietschmann, Völkel & Ohler, 2014).

Considering all the development theories mentioned previously in this section, it is evident that children need time and stimuli to develop. As the development of media literacy and media competence follows cognitive development, older children possess more robust media skills than younger children, and it is paramount to consider this aspect when producing educational media for this target audience.

Neuropsychological foundations for learning: insights from Mind, Brain, and Education

Mind, Brain, and Education is a field of study that combines research on Psychology, Neuroscience, and Education and starts from the assumption that the brain is a plastic, affective, dynamic, and experience-dependent organ. Thus, research in this area is based on the notion that just as biology shapes the development of the children, experience shapes their biology (Immordino-Yang & Fischer, 2010; Rato & Castro-Caldas, 2017).

Although the findings of the research in this field are traditionally applied to educational practices and research within the classroom environment and in formal learning, they are equally important for understanding how the human brain learns in other environments, physical or digital, formal or informal, since learning is a natural process that occurs regardless of the learning source (Falk & Dierking, 2000).

The reviewed literature on this field suggests that childhood is a critical period for learning (Sousa, 2017), which is more likely to happen within specific “windows of opportunity,” i.e., periods in which the brain is especially open to absorbing the stimuli that it receives from the environment, and to create new neural connections from them (Rato & Castro-Caldas, 2017). These “windows of opportunity” are abundant in

childhood and decrease with age and brain maturation, vary between different skills, and have different lengths for each (Hensch, 2005).

This is not to say that it is impossible to learn a new skill after its “window of opportunity” tappers off. The neuroplasticity of the brain, i.e., its capacity to modify itself with experience by developing, strengthening, and modifying neural networks from the influence of environmental interactions, makes learning possible to occur throughout the entire life of the individual (Hardiman, 2012). Nonetheless, it becomes more energy-demanding after specific periods (Blakemore & Frith, 2009).

The human brain begins to develop in utero and continues to develop throughout the whole life of the individual, depending on both genetic and epigenetic (environmental) conditions. The brain regions develop in specific waves of development, i.e., not all the regions develop and mature simultaneously. For instance, the cortical regions that are related to primary functions (such as the motor and sensory systems) mature in early childhood, while cortical regions that are dedicated to aspects such as decision-making and moderating behavior only mature at the end of the adolescence period (Rato & Castro-Caldas, 2017).

Throughout this development process, between childhood and adolescence, the neurons that are not successful in creating connections with other neurons (synapses) are pruned (Farmer-Dougan & Alferink, 2013). This pruning (or removal) of the unnecessary neural structures gives room for the development of higher-quality neural connections that can support mental functions of greater complexity (Rato & Castro-Caldas, 2017).

A rich surrounding environment in childhood, in what regards visual, auditive, gustatory, olfactive, and tactile stimuli, is paramount for the development of the perceptual systems, i.e., the sensorial areas of the brain (Blakemore & Frith, 2009). Therefore, it is also crucial for learning since learning starts from the encoding of sensory experiences, i.e., from the cognitive processing of stimuli that are experienced from the environment by the human perceptual systems, such as sight, hearing, taste, smell, and touch (Hogan, 2003).

After receiving the sensory information, so that learning can happen, it is necessary that the working memory encodes it and that the long-term memory stores it afterward. Nonetheless, these processes only occur under certain conditions (Sousa, 2017). These conditions are the capacity and limits of the perceptual systems (e.g., the range of frequencies that the human ear can pick up), of the cognitive structures that process information (e.g., the limits of the working memory), and also the relevance of the sensory inputs for the individual. What is not encoded is not processed by the working memory and is consequently neglected or forgotten (Hogan, 2003).

In what regards to the limits of the cognitive structures, the limit of the long-term memory is not yet defined in the literature. Nonetheless, in what concerns the working memory, several studies have already demonstrated that its capacity is very small in young children and increases with age (Sousa, 2017). This type of memory (that is part of the executive function – EF) is paramount for learning because it represents the capacity to retain the information needed to complete a task within the mind. In what regards to preschool children, since the capacity of the working memory within this period is significantly limited, it is important not to ask for the completion of more than one task at a time (Rato & Castro-Caldas, 2017).

Regarding the relevance of the stimuli for the learner, it is dependent on how much sense and meaning he/she attaches to the learning, and these are dependent on factors such as comprehension, emotion, motivation, attention, and repetition (also known as “rehearsal”) (Sousa, 2017).

Cognitive factors that influence learning: comprehension, emotion, motivation, attention, and repetition

Comprehension and cognitive schemas

Comprehension is a paramount factor for learning because, as the literature suggests, the content that does not make sense to the learner is more difficult to be cognitively processed by the working memory (Sousa, 2017). Therefore, when

presenting educational content to a group of learners, to maximize comprehension, it is crucial to start by acknowledging their language comprehension skills, and adapt the linguistic content when necessary, so that the educational content can be presented clearly and understandably.

An important aspect to consider about comprehension is that it is not only dependent on language understanding factors but also on the mental structures of the learner, i.e., on the previous knowledge that he/she possesses. These mental structures are named schemas (or schemata) and have been defined in the literature as cognitive structures that represent generic knowledge about the general form of entities, instances, and events (Emmott & Alexander, 2014).

Schemas are socioculturally dependent and derive from the experience and learning of the individual, thus developing throughout his/her life. To interpret contexts and scenarios in everyday life, people employ the cognitive and social schemas they have already acquainted (Emmott & Alexander, 2014).

When incoming information does not find correspondence in the cognitive schemas of the learner, it is more likely to be neglected or forgotten (Hananberg, 2011). As new knowledge is constructed from a foundation of previous knowledge, it is necessary to attend to the knowledge that the learner already possesses to allow new knowledge to make sense (Falk & Dierking, 2000).

The Theory of Cognitive Development of Jean Piaget, for instance, starts from the concept of schemas to explain how children develop cognitively and adapt to the world. This author claims that cognitive development depends on two processes involved in the negotiation between the schemata that children have and the receiving of new information. When new information and existing schemas match, schema assimilation occurs, i.e., the child uses the existing schema to deal with the new information. Conversely, when these two parts do not match, there is a process of schema accommodation, i.e., the existing schema needs to be changed to deal with the new information (Piaget, 1936).

Although Piaget has not initially related his theory to learning, his research was later applied to Education Sciences and remains one of the most influential theories explaining how children assimilate and accommodate knowledge.

Emotions

Emotions are a critical factor for learning because cognition is strongly dependent on them, and they modulate the recruitment of neural networks for specific skills (Immordino-Yang & Fischer, 2010).

Positive emotions can stimulate the amygdala to activate brain regions that enhance memory (Sousa, 2017). In addition, when the learner is practicing pleasant activities, the brain increases the production of dopamine, which stimulates the memory centers and facilitates the release of acetylcholine, increasing his/her attention (Rato & Castro-Caldas, 2017).

Conversely, since the emotional memory is more influential and permanent than other types of memory, when a negative emotion is attached to the learning experience, this type of memory may block new learning on a particular subject, requiring neural changes beyond behavioral conditioning (Tokuhamma-Espinosa, 2011). Several studies using imaging techniques such as PET (Positron Emission Tomography) and fMRI (Functional Magnetic Resonance Imaging) have demonstrated that under stress conditions, the access to information in areas of the brain that are related to higher memory consolidation and storage is blocked. In other words, when stress activates the affective filters of the brain, the information flow towards higher neural connections is limited, and the learning process is interrupted (Rato & Castro-Caldas, 2017).

This is because when the learner feels stressed, a hormone that activates defense behaviors (cortisol) is released, triggering the frontal lobe to focus on the cause of the stress and neglecting the educational content. Thus, it is important to stimulate a positive and stress-free learning environment, which can be promoted by

using pedagogical strategies within the learning experience, such as humor and strategies for generating interest (Sousa, 2017).

Regarding humor, the literature suggests that it provides more oxygen into the bloodstream, promotes the releasement of endorphins (which give a sensation of euphoria and enjoyment to the learner, stimulating the frontal lobes and increasing both the focus and the attention span), and moderates body functions (decreasing stress and blood pressure, modulating pain, and relaxing muscle tension) (Sousa, 2017).

Several studies have demonstrated that humor can draw the attention of the learners to the educational content, promote creativity, and facilitate the retention of information (Bryant & Zillmann, 2013). Therefore, humor can be a powerful tool for creating a positive and effective learning environment. Because humor varies between age and individuals, it is important to identify what types of humor are adequate for each type of learner (Sousa, 2017).

In what concerns interest, even though it is hard to determine neurobiologically, it is part of the exploratory compulsion inherent to the human being (Castro-Caldas, 2012). Interest is one factor that influences the selection of the brain on what to attend. Thus, it prioritizes certain stimuli over others and determines which are more relevant for the learner (Falk & Dierking, 2000).

The literature suggests that since interest varies significantly from learner to learner, an effective strategy for generating it is providing feedback throughout the learning experience. Studies have demonstrated that learners are more likely to persist in learning when they are prompted with corrective feedback on the results of their thinking. When this procedure occurs, they tend to make corrections and persist until they complete a task (Hattie, 2012).

In addition, although anxiety is generally seen as a negative factor for learning, when the learner experiences helpful anxiety, i.e., a desire to do well, the degree of learning increases since he/she puts more effort into it. Thus, if an optimum level of anxiety is triggered within the learning experience, it becomes more efficient. This can be achieved by presenting the consequences of learning a certain subject, giving the

learner limited time to complete a task, or limiting the amount of help available to complete a learning task (Hunter, 2004).

Interest is intricately linked to motivation, and they both determine whether an item is relevant or not for the learner.

Motivation

Motivation is fundamental in determining the processing of information by the working memory. Therefore, it is paramount for learning. As the literature suggests, people motivated to learn a subject are more likely to dedicate more time to pursuing knowledge. Moreover, motivation for learning can be internally or externally driven, i.e., promoted by internal or external factors. In addition, it can be positive or negative, whether the learner is involved in the learning experience to feel good or respond to fear. This has a different impact on the willingness to repeat the experience and on the learning outcomes (Tokuhamma-Espinosa, 2011).

Several studies have demonstrated that motivation is chemically managed by dopamine and serotonin, two neurotransmitters that significantly affect the executive function, as well as the reward and novelty-oriented behavior of the individual. As the levels of dopamine increase with reward, it influences the behavior to obtain more and more of it. Regarding serotonin, it regulates humor and emotional states, influences behavior by inhibiting thoughts and impulses, and shapes the interpretation of information (positively or negatively) by activating the hippocampus. With optimum serotonin levels, the learner is more likely to regulate and control his/her behavior and feel more motivated to learn (Rato & Castro-Caldas, 2017).

Thus, the more rewarding the learning experience is, the more the learner will feel motivated to repeat it.

Attention

Attention is crucial for learning because what the learner does not attend to is not learned. The primary function of the brain is to detect potential threats to the life of the individual. Thus, the brain constantly scans for stimuli in the environment that can be a menace. For that reason, the environment must be relaxed so the learner can focus on something. Notwithstanding, since the brain is a novelty seeker by nature, if the object on which the individual is focusing his/her attention has several repeated or predictable stimuli, the attention to those stimuli becomes significantly reduced over time, and the brain tends to focus on other novel stimuli (Sousa, 2017).

In other words, if the learning experience is too predictable or repetitive, it is harder to maintain the attention of the learner, which will inevitably shift his/her attention to other stimuli.

Repetition

Finally, repetition (or rehearsal) is paramount for learning because it facilitates the reinforcement of neural connections, i.e., the strengthening of neural networks that facilitate the storage of content in the long-term memory by processing and reprocessing it continuously (Sousa, 2017).

Long-Term Potentiation (LTP) is the process in which the neurons that fire together as a response to a stimulus strengthen their connection. It occurs when there is a repeated high-frequency neural stimulation and a consequent releasing of neurotrophins, chemicals that reduce the plasticity of the synapses and strengthen them. This process is critical for developing and strengthening memory circuits, and several studies have demonstrated that repetition-based activities facilitate their maintenance (Farmer-Dougan & Alferink, 2013). Thus, the repetition of the same sensory input or motor activity (practice) leads to a major probability of the brain learning it (Hardiman, 2012).

Furthermore, the literature suggests that time is a critical factor for repetition (also named “rehearsal”) because providing time between the initial processing and the reprocessing of content allows the learner to review, make sense, and attach meaning to it. Thus, time intervals between repetitions increase the probability of storing information in long-term memory (Sousa, 2017).

It is often necessary to employ pedagogical strategies to promote the retention of the educational content in the long-term memory, whether by facilitating the attachment of meaning to the learner or by distributing the educational content throughout the learning experience as efficiently as possible.

Using memorizing strategies such as mnemonics, for instance, can enhance the retention of the educational content by adding an artificial meaning to it. In addition, the literature suggests that it is important to consider the primacy-recent effect (or serial position effect) within the learning experience to not exceed the capacity of the working memory of the learners. The primacy-recent effect is the tendency to remember best what is presented in the first place, then what is presented in the last place, and to remember least what is presented in between. Following this recommendation, new educational content should be taught first (only correct information), summarizing the new information should come last (as closure) and reviewing other educational content should be done in the middle time (as rehearsal). Furthermore, the shorter and more meaningful the learning episode is, the longer the times in which effective learning takes place (Sousa, 2017).

Why different types of learning result in different learning outcomes

An important aspect to consider about learning is that not all learning is explicit, i.e., not all learning is based on the conscient acquisition of concrete content that the brain processes and stores in the long-term memory, within a conditioned environment. Most learning occurs, in fact, naturally, in several subtle manners that differ between learners. These learning experiences can occur within the most varied

contexts, such as reading a book, fixing a machine, watching a movie, playing sports, or solving a puzzle, and the learning outcomes from these experiences can be revealed in the most unpredictable situations (Falk & Dierking, 2000).

This type of knowledge, which some authors name “tacit knowledge” (Collins, 2010; Hanenberg, 2009), is acquired through a process of implicit learning, i.e., a type of learning that does not imply a conscient effort (Berkowitz, 2010). Related to the distinction between explicit and implicit learning is the difference between declarative (or explicit) and nondeclarative (or implicit) memory. Whereas declarative memory is related to remembering events, facts, names, and objects and is processed by the cerebrum and the hippocampus, nondeclarative memory is related to memories that cannot be narrated or described. The nondeclarative memory is necessary to perform physical tasks (such as riding a bicycle or driving a car) and for cognitive tasks (such as reading, identifying tones in music, or solving a problem) (Sousa, 2017).

Cultural codes, for instance, are learned implicitly, similarly to the acquisition of the cognitive schemas mentioned previously in this work. These codes are acquired through cultural experience, in which the individual learns how to read and predict the intention of others (by performing “mind-reading”), to formulate hypotheses from a particular cultural scenario (thus developing intuition and the cognitive ability of problem-solving), and to structure thoughts (by following cultural-specific cognitive mechanisms). The human brain learns cultural codes such as social conventions and gender codes from a very young age, informally and implicitly, usually by observing the social interactions within the cultural environment of the individual. Therefore, culture is not innate but rather something that is learned (Hanenberg, 2009).

Audiovisual products can impact the construction of the social codes and perceptions of children, as part of the cultural environment that surrounds them. As mentioned in the Introduction, the frequency and regularity in which people are exposed to specific images and representations of social and cultural issues can shape their attitudes in the physical world (Messenger-Davies, 2010). Thus, educational videos should be considered an important tool for child development in what concerns explicit and implicit knowledge.

Assessing learning outcomes

The outcomes of the learning experience can be of the broadest nature within the cognitive, psychomotor, and affective domains. As the literature posits, the cognitive domain refers to the intellectual dimension of learning, being related to the acquisition of intellectual knowledge; the psychomotor domain refers to the acquisition of motor or physical skills; and the affective domain refers to the emotional dimension of learning, in which the learner receives and responds affectively to the learning experience, being the final stage the internalization of acquired values (Bloom, Engelhart, Furst, Hill & Krathwohl, 1956; Krathwohl, Bloom & Masia, 1964).

Just as learning has several dimensions, it encompasses several levels as well, and these levels have been presented in the literature through several learning taxonomies. One of the most cited in the field of Education Sciences is the Learning Taxonomy of Bloom (Bloom, Engelhart, Furst, Hill & Krathwohl, 1956; revised by Anderson & Krathwohl, 2001). Figure 1 presents the six levels of learning in the cognitive domain: remembering, understanding, applying, analyzing, evaluating, and creating.

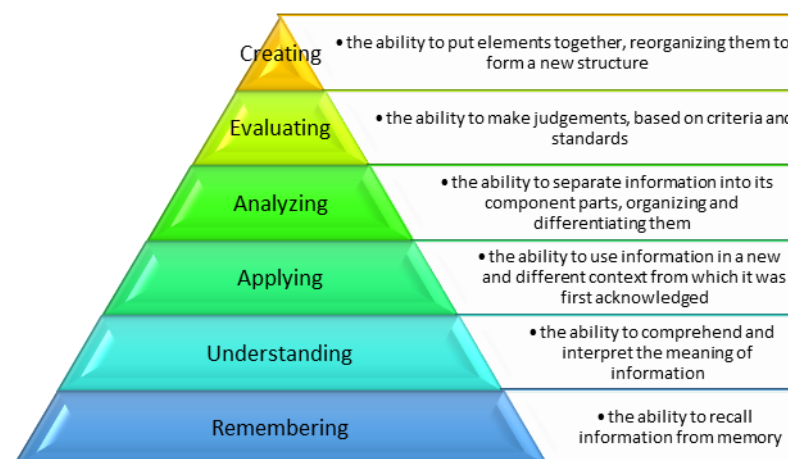


Figure 1 – Learning Taxonomy of Bloom (original stages renamed and revised by Anderson & Krathwohl, 2001) (source: the author)

The levels mentioned above have been systematically used not only to design learning objectives and define pedagogical strategies but also to choose what methodologies should be used in what regards the assessment of the learning outcomes. Different learning outcomes have different forms of assessments because it is different to assess the ability to remember information than the ability to create new structures from the reorganization of acquainted concepts, for instance.

Bearing this in mind, for assessing the learning outcomes from educational videos, it is paramount to define the objective of the assessment, i.e., to specify which learning level the assessment addresses. The definition of the objective will determine which methods should be used for the assessment and which skills the learner should demonstrate. For guiding such a task, some authors have listed a set of action verbs (measurable verbs) starting from the Learning Taxonomy of Bloom (see Newton, da Silva & Peters, 2020). These verbs are presented in Table 2 and can be applied in the wording of questions in written and spoken format.

TABLE 2	
Stage	Action (measurable) verbs
Remembering	List, define, recall, state, label, repeat, name
Understanding	Translate, paraphrase, discuss, report, locate, identify, generalize, explain, classify, summarize
Applying	Operate, apply, use, demonstrate, solve, produce, prepare, choose
Analyzing	Analyze, question, differentiate, experiment, examine, test, categorize, distinguish, calculate, contrast, outline, infer, discriminate, compare
Evaluating	Rate, evaluate, assess, judge, justify
Creating	Create, compose, argue, design, plan, support, revise, formulate

Table 2 – Action (measurable) verbs for each stage within the Learning Taxonomy of Bloom (adapted from Newton, da Silva & Peters, 2020; original stages renamed and revised by Anderson & Krathwohl, 2001)

Learning from educational videos: overcoming the video deficit and beyond

As mentioned previously, learning is the process through which human beings acquire new skills and knowledge (Sousa, 2017). It can occur within the most varied contexts, and educational media products can facilitate the learning experience for many learners. These products differ from others (e.g., entertainment-only) to the extent that they are created to foster the acquisition of skills and knowledge by educating and informing. Educational videos are one type of educational media, and, as the literature suggests, learning from them involves acquiring, encoding, storing, and retrieving information that can permanently impact behavior or knowledge (Linebarger & Piotrowski, 2010).

Educational videos are usually curriculum-driven objects with a conscious plan to teach (Kirkorian & Anderson, 2008; Linebarger, 2015). They are expected to meet quality requirements defined within the television context, which remain valid for digital platforms. These requirements are clarity, integration (there should be repetition and incorporation of the educational content throughout the program), involvement, applicability (the educational content should be connected with the physical world), importance, and reinforcement (the learning of the educational content should be rewarded within the program) (Jordan & Woodward, 1997).

Educational videos can enhance learning on several subjects from a very young age (Fisch, 2004). Besides contributing to school readiness in domains such as language, mathematics, and literacy, they can contribute to the development of motivation and interest in these fields, as well as for the acquisition of behavioral patterns of concentration, attentiveness, and non-distractibility (Huston, Anderson, Wright, Linebarger & Schmitt, 2001). As longitudinal studies have demonstrated, these behavior patterns lead to the achievement of higher grades and for an increasing book reading and creative thinking in adolescence (see Anderson et al., 2001). Nevertheless, not all children of all ages can learn from educational videos, nor can all the videos that are labeled as educational content provide effective learning, even if they are

produced with a specific curriculum in mind (Linebarger, Brey, Fenstermacher & Barr, 2017).

Studies suggest that it is not before the age of two that children begin to be able to transfer what is seen on audiovisual media to the physical world, and it is only at the age of three that this transference can be fully achieved due to a lack of maturation in several cognitive, perceptual, and social processes that lasts until the end of their second year of life (Courage, 2017). This “video deficit” (Barr, 2010), which is present in children younger than three years old, has been noticed in studies concerning the imitation of actions, word-learning, object-retrieval, and language-recognition tasks (see Kirkorian et al., 2016; Krcmar, Grela & Lin, 2007; Troseth & Deloache, 1998; Troseth, Saylor & Archer, 2006). It arises from difficulties in making correspondence between the two-dimensional format of the video and the three-dimensional format of the physical object; the lack of understanding that video is a representation of a physical source; and the contrast between the responsiveness of their everyday life and the lack of interaction in the video, what leads children to perceive it as irrelevant (Courage, 2017). Furthermore, children under two years old still lack sharpness and high-contrast in vision that are fundamental to be focused on audiovisual media (Pietschmann, Völkel & Ohler, 2014).

Therefore, even though co-viewing audiovisual products with other family members, who comment on what is being viewed, can enhance learning from videos in younger children (Kirkorian & Anderson, 2008; Fisch, 2013b; Samudra, Flynn & Wong, 2019), it is only from 3 years old on that children can effectively learn from them. From that age on, it remains a cognitively challenging task because it is necessary to process the video and the audio components within the limits of the working memory. Nonetheless, those challenges can be mitigated if the producers embed cognitive and pedagogical strategies in their productions.

The Dual Coding Theory suggests that learning from sources that provide visual and auditory information is more efficient than other sources because these two sensory inputs do not compete for the same processing resources (Clark & Paivio, 1991). This claim can be supported by the Working Memory Model proposed by Baddeley and Hitch (1974).

In the Working Memory Model, these authors claim that the working memory is divided into three components, namely the phonological loop (that processes auditory information by rehearsal), the visuospatial working memory (that processes visual information), and the central executive (that coordinates the information that is processed by the other two components).¹ According to this model, combining images and words/sounds is beneficial to learning, and this presupposition is especially valid if both components complement each other and the learner can fully process the information (Samudra, Flynn & Wong, 2019).

Similarly, the Cognitive Theory of Multimedia Learning, which also starts from the assumption that there are two separate channels for receiving information (visual and auditory) with limited capacity, suggests that the more complex are the elements in both sources (pictures and words), the lower is the capacity for cognitively processing and retrieving information from them. This theory claims that learning from videos requires the selection of relevant words and images, followed by the organization of those words and images towards the creation of verbal and pictorial models in the working memory, and then by integrating these models with prior knowledge (Mayer, 2014a).

Regarding preschool children, the visual component in educational videos is critical, since young children are not yet able to efficiently rehearse the auditory information within the phonological loop of the working memory (Palmer, 2000). Therefore, they are dependent on visual strategies for memory, and auditory reinforcing strategies, such as vocabulary labeling within the videos and co-viewing dialogical practices (Samudra, Flynn & Wong, 2019).

¹ Another component was later added to this model, the episodic buffer, which is related to the integration of verbal, spatial, and visual information into a time sequence (see Baddeley, 2000).

Cognitive strategies for educational videos

Learning from educational videos is dependent on factors such as the comprehension of the narrative and the educational content. In addition, it depends on the achievement of a transfer of learning, i.e., to apply what was learned on the video to other contexts in everyday life by creating an abstract representation of the knowledge that was acquainted (Fisch, 2013b).

Audiovisual media can be challenging to the transference of learning because the two-dimensional format of the screen contrasts with the three-dimensional nature of everyday-life contexts. This challenge is more significant if the scenarios, characters, and story schemas do not match what children find in everyday life (Kirkorian & Anderson, 2008). As children may experience some difficulties in transferring knowledge from one scenario to the other, especially in what concerns preschool children, some strategies should be applied to overcome these challenges and produce educational content children can comprehend and learn.

Narrative and educational content

To begin with, the choice of a narrative over an expository format, i.e., short and separated vignettes that deliver information, is supported by studies that have demonstrated that the expository format is harder to process cognitively. Therefore, narrative formats have been related to higher comprehension and learning outcomes (Linebarger, Brey, Fenstermacher & Barr, 2017; Linebarger & Piotrowski, 2010).

The narrative structure is the first format with which children contact from a very young age, and the basic structure of the narrative, fundamental for comprehending a story, is already mastered before school age. Several studies have shown that at about 2 and a half years old, many children demonstrate basic knowledge of a narrative structure, and at about 4 years old, this knowledge is even more noticeable with the use of narrative marks (Sim-Sim, 1998).

In educational videos, it is paramount that the educational content and the narrative are intertwined in the video because they both compete for the available resources in the working memory of the children who watch the content (Fisch, 2013b).

According to the Capacity Model Theory (Fisch, 2004; 2000), the cognitive processing of the several stimuli that arise from an audiovisual product, such as videos, is a complex cognitive task. Thus, the comprehension of the educational content is dependent on the following: a small cognitive processing demand of the narrative, a small cognitive processing demand of the educational content, or a small distance between narrative and educational content (Fisch, 2017).

How the narrative and the educational content should be combined is somehow complex to determine. On the one hand, the distance between both components should be small in order to facilitate the cognitive processing of both elements by the working memory; on the other hand, the educational content should not be utterly integral to the narrative so that the children can transfer what is learned on the video to other contexts in the outside world (Fisch, 2017).

An efficient solution for this problem can be the presentation of the same educational content in different narrative contexts within the educational videos and on different platforms, promoting a cross-platform learning process that can reinforce learning and facilitate the transfer of learning (Fisch, 2017; 2013b).

When the same content is presented on multiple platforms, there is a synergy between those platforms that make them complementary. The specificities of each medium require the use of different cognitive skills by the children, which provides them with a deeper understanding of the educational content and a more comprehensive representation of it (Neuman, 2005).

In order to achieve a low demanding narrative in what concerns its cognitive processing, it should be presented clearly and sequentially, should consider the established story schemas, i.e., it should consider the structure of a story with which the children are used to contacting, and it should not require the inference of implicit content. The need to reduce the cognitive load of the narrative to process the

educational content derives from the fact that humans use the same cognitive and social schemas to process media content that they use in every other situation in their everyday life (Fisch, 2017).

In narrative studies, the schema theory has contributed to explaining how a reader has expectations on how a story continues, and how he/she can make inferences from general knowledge to process specific parts of a text. Every time new events contradict the existing schemas, these are transformed to accommodate new generalizations (Emmott & Alexander, 2014).

The cognitive processing of a visual narrative occurs similarly to literature, and since the transformation of an existing schema is a cognitively demanding task, the presentation of a narrative under a different structure from which children are used to contacting with increases the cognitive load of the narrative, thus decreasing the available resources in the working memory to process the educational content.

Sociocultural contexts and scenarios

Studies have demonstrated that learning from educational videos is more likely to occur when the narrative encompasses scenarios that are familiar to the children, such as at home or the park (Linebarger, Brey, Fenstermacher & Barr, 2017). When the narrative settings do not match the pre-existent cognitive schemas of the children, it requires the formation of new schemas, which increases the cognitive load of the narrative and therefore reduces the possibility of learning from the videos, as explained above.

Besides familiar contexts, to facilitate learning from educational videos, it is crucial to use characters who look similar to the children or their peers, or to whom the children can relate (e.g., adults who belong to a similar socio-cultural context to the children or characters that are already familiar to the children). This is because social learning in young children occurs from the imitation of behavioral patterns of others to whom they can relate, and this can happen through everyday life

interactions and through watching characters in the videos that model these interactions (Linebarger, Brey, Fenstermacher & Barr, 2017).

Thus, a diverse cast of characters encourages identification with the ones who are more similar to the children, and this is important because studies suggest that children tend to pay more attention to models that are similar to themselves (Fisch & Truglio, 2001). Similarly, the use of characters that are already familiar to the children is pointed out in the literature as being efficient for educational videos since children can treat these media characters as social partners and build parasocial relationships with them (Calvert et al., 2019).

Fantasy vs. reality

Fantasy elements, such as fantasy characters and/or environments, have often been used in videos targeting children (especially in animation), based on the assumption that this audience would be more engaged and pay more attention to what they were viewing. Nonetheless, several studies have demonstrated that regardless of the attention that children may pay to these elements, the use of fantasy in educational videos is not as efficient as the use of real characters and contexts, especially in what regards to young preschool children (Richert, Shawber, Hoffman & Taylor, 2009).

Children tend to select the elements in their environment that provide reliable information for learning, and this selection is extended to media characters. By five years old, most children can differentiate what actions can and cannot happen in the real world, and if they have experience with fictional stories, they can consider that some information from the fantasy domain can be transferred to the real world (Richert, Shawber, Hoffman & Taylor, 2009). Moreover, by three years old, several children already assume that fantasy characters are pretending on videos, and they tend to select realistic characters as reliable sources of information rather than fantastic ones (Richert, Robb & Smith, 2011). These findings have clarified why some educational videos are more effective than others, especially in what regards to the transfer of learning.

Furthermore, some studies suggest that the exposure to fantastical content in animated videos can have a negative impact on several executive function skills of young children in the short-term because this type of content can be cognitively demanding to process (Lillard & Peterson, 2011; *Lillard, Drell, Richey, Boguszewski & Smith, 2015*; Scarf & Hinten, 2018).

Perceptually salient features

Other cognitive strategies have been indicated in the literature as paramount to maximizing learning from educational videos. The use of perceptually salient features, for instance, such as sound effects and non-speech vocalizations, has been pointed out as being efficient in recruiting the attention of younger children to educational content, thus resulting in significant learning outcomes, mainly when the children fully comprehend the content of the videos (Kirkorian & Anderson, 2008).

Unusual audio and visual effects trigger the attention of children who have little experience with television and perceive these stimuli as being novel. This is because children make several attentional decisions while watching videos, based on attentional cues and the level of comprehensibility (Linebarger, 2015). The stimuli that are perceived to be of moderate novelty and intermediate complexity, as well as regular, organizable, and ordered, are expected to be the most interesting and more efficient in recruiting the attention of the viewers (Huston & Wright, 1989; Linebarger, 2015).

Nonetheless, it is important to highlight that educational effectiveness is only achieved when perceptually salient and other attractive features coincide with the educational content. Otherwise, children will only remember the attractive features, not the educational content (Palmer & Fisch, 2001).

Repetition in educational videos

As previously mentioned in this work, repetition is an efficient strategy for maximizing learning (Kirkorian & Anderson, 2008; Linebarger, Brey, Fenstermacher & Barr, 2017; Sousa, 2017). There are two different modes of applying this cognitive strategy to educational videos: repetition of the same educational topic within an episode; and the repetition of the episodes (or of segments of an episode).

Regarding the first type of repetition (the repetition of an educational topic within an episode), it has been pointed out in literature as being an efficient strategy for enhancing learning by presenting the same educational material in different manners (e.g., through songs, through different visual supports, or in different contexts or scenarios), which reinforces the comprehension of the educational material, and the application of the acquired knowledge (Fisch & Truglio, 2001; Linebarger, Brey, Fenstermacher & Barr, 2017).

In what regards to the second type of repetition (the repetition of the episodes), studies have demonstrated that for the children who repeatedly watched the same episode of an educational program, the recall of the educational content was higher than for the children who watched the episode only once (Crawley, Anderson, Wilder, Williams & Santomero, 1999; Kirkorian & Anderson, 2008).

Moreover, not only did the visual attention of the children who watched the episode repeatedly not decrease, but also their participation increased by answering questions asked by the characters, laughing, and pointing. These children outperformed those with a single view of the episode, both in problem-solving tasks similar to those shown in the episode and in the transfer of learning (Crawley, Anderson, Wilder, Williams & Santomero, 1999; Kirkorian & Anderson, 2008).

Pedagogical strategies for educational videos

In what regards to pedagogical strategies, studies have demonstrated that including “wh-questions” on educational videos, such as “who,” “what,” “why,” and

“where,” as well as yes/no questions, can enhance verbal reasoning in preschool children, which involves processing the content in a logical and organized manner, prompting the children to make predictions and classifications, and to identify differences and similarities between objects and actions (Reese, Sparks & Leyva, 2010). When combined with parasocial interactions, e.g., characters who look at the camera and ask questions to the viewers, inviting them to participate, pausing to allow them to answer, and giving feedback on the possible answers, these types of participatory strategies have been pointed out in the literature as being efficient in promoting engagement, interaction, comprehension, and learning of the educational content (Krcmar & Cingel, 2017; Calvert et al., 2019).

In addition, labeling and commenting on the objects displayed and matching verbs with the actions shown on the screen are of great importance to increase the learning of new vocabulary. Furthermore, these strategies are fundamental to overcoming the limitations of the screen when compared to the physical and three-dimensional format of the everyday-life contexts, thus facilitating the transfer of learning. It is important, though, that the videos do not include mismatched labeling. Moreover, prefacing and summarizing have also been pointed out as efficient conversational strategies both for recruiting the attention of the children for the content to be presented and for recalling the content presented in the educational video. Finally, the curriculum should be well defined and meet its goals (Linebarger, Brey, Fenstermacher & Barr, 2017).

The role of engagement in learning from educational videos

Within the media landscape, engagement is a concept that can have several definitions, depending on its context: it may refer to the relationship between producers and creatives, being related to collaboration and coworking; between broadcasters and audiences, being related to ratings, reach, and share; between programs on communities and public debate, being related to public impact, strategic

decisions, among several other possibilities (Hill, Steemers, Roscoe, Donovan & Wood, 2017).

In the context of this work, we consider engagement as a concept that involves attention, interest, and enjoyment fostered by stimulating activities or actions and encompasses emotion, self-direction, interaction, and choice (Noorhidawati, Ghalebanti & Siti Hajar 2015). Engagement with technology, in general, is characterized by aesthetic and sensory appeal, challenge, novelty, feedback, interactivity, awareness, perceived control and time, interest, and affect (O'Brien & Toms, 2008), and media engagement encompasses several of these aspects.

Children experience engagement when the activities they participate in are interesting, personally enjoyable, or socially meaningful to them, and are in their zone of proximal development. When they are engaged, children not merely observe but often participate with their whole bodies, persisting in the activity, especially if it is challenging (Roskos, Burstein & You, 2012). Persistence, enthusiasm, and compliance (staying focused and following directions) are strongly related to engagement (Moody, Justice & Cabell, 2010).

Media engagement in preschool children has often been assessed in the literature starting from observing three behavioral categories: control, multi-sensory behaviors, and communication (Roskos, Burstein, Shang & Gray, 2014). This typology is grounded in research on engagement with e-books, and the three categories mentioned above are related to the salient behaviors described in Table 3.

TABLE 3			
Category	Definition	Salient behavior(s)	Definition
Control	Power to take action and to see the results of the decisions and choices	Operating the device	Quick, easy access to and use of control buttons on devices; direct participation
Multisensory behaviors	Using visual, auditory, and haptic-kinesthetic senses	Looking	Eyes directed to the screen
		Touching	Fingers applied directly to the screen
		Listening	Attending the audio stream, not talking
		Moving	Positioning to view the screen
		Gesturing	Using bodily actions to communicate
Communication	Using verbal and nonverbal behaviors to respond to language and express communication	Facial expressions	Using facial gestures to express thoughts and feelings
		Making noises	Using sounds to express thought and feelings, such as squealing, laughing, gasping, etc.
		Language	Using speech to comment, answer questions, and ask questions

Table 3 – Categories and salient behaviors of engagement in preschool children when interacting with e-books (source: adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014).

Similarly, research on the engagement of children and mobile applications of diverse genres has been assessed in the literature considering the domains described on Table 4.

TABLE 4		
Engagement conditions	Definition	Salient behavior(s)
Collective sensory skill	Reflects sensory-motor skills	Looking
		Touching
		Listening
		Gesturing
Emotional expression	Reflects the occurrence of facial expressions and noises made during interaction with mobile apps on touch-screen devices	Positive
		No expression/gazing
		Negative facial gestures
Verbal expression	Reflects the verbal expressions that the children give during the interaction with mobile apps on touch-screen devices	All types of verbal expressions

Table 4 – Categories and salient engagement behaviors in preschool children when interacting with diverse mobile applications (source: adapted from Noorhidawati, Ghalebanti & Hajar, 2015).

The relationship between the engagement of children and learning has been primarily investigated in the literature within the field of mobile applications. Within this scope, studies have demonstrated that engagement influences learning on different levels. These levels are related to different learning experiences and outcomes, such as cognitive (related to the acquisition of knowledge), psychomotor (related to the acquisition of action or motor skills), and affective (related to the association of positive or negative feelings and emotions to the object of the learning experience (Noorhidawati, Ghalebanti & Hajar, 2015).

For instance, when children engage with apps using sensory-motor skills, the learning outcomes tend to be of cognitive and psychomotor nature. When they express themselves emotionally or verbally, the learning experience tends to result in more psychomotor and affective skills (Noorhidawati, Ghalebanti & Hajar, 2015).

Since learning from educational videos does not afford the possibility of engaging in some sensory-motor behaviors, such as touching the screen to complete a task, for instance, it is paramount to ensure that both the visual and the auditory components of the video are designed and displayed aiming to enhance the engagement of the children and the learning experience overall.

Appeal (i.e., the quality of being attractive or interesting) and engagement are two crucial characteristics that educational videos should have so that children can learn from them. To begin with, videos that are not appealing do not *attract* the attention of the viewers. Secondly, videos that are not engaging do not *retain* the attention of the viewers. Therefore, the lack of these two features can jeopardize the learning experience of educational videos from the beginning.

Moreover, the literature suggests a strong relationship between engagement and comprehension since studies have demonstrated that engagement can aid comprehension (due to increased attention) and comprehensible content becomes more engaging (Fisch & Truglio, 2001).

The role of families and kindergarten teachers in learning from educational videos

The literature suggests that parents mostly perceive the concept of educational content as related to the acquisition of knowledge and skills which are also trained within the school context, even though some families consider that digital media can foster other important skills. As most parents rely on the opinion and advice of teachers and kindergarten teachers about what is adequate for their children, the latter have a crucial role as technology mediators. Thus, teachers and kindergarten teachers are valuable information sources and should clarify the doubts of the families, as well as guide them towards searching for reliable information about good practices in the use of digital media (Dias & Brito, 2018).

Whether at home or at kindergartens, co-viewing educational videos with adults who comment, make questions and repeat content that is being viewed has

been pointed out in the literature as being efficient in maximizing learning, especially regarding vocabulary learning (Strouse, O'Doherty & Troseth, 2013).

This can be because preschool children are dependent on visual supports, rather than auditory, for memorizing content from audiovisual media. Thus, co-viewing practices such as pausing the video and conversing with the child about the storyline can facilitate its comprehension, reinforcing the auditory information and promoting its retention in the long-term memory. Nonetheless, this type of dialogical practice is not very likely to occur within the families (Samudra, Flynn & Wong, 2019).

According to the Social Development Theory (Vygotsky & Cole, 1981), the scaffolding given by parents and other caregivers is paramount for learning because they can help the children to move forward to the next stage of knowledge acquisition, helping them to solve problems with an increasing level of difficulty (Richards & Calvert, 2017). Therefore, it is important to establish good practices for family co-viewing of educational videos to enhance learning from them.

Nevertheless, the dynamics of watching videos on digital platforms such as YouTube often imply that the children are autonomous in using them without the supervision of an adult (Ponte, Simões, Batista, Castro & Jorge, 2017). Moreover, autonomy in watching is one of the main objectives of platforms such as YouTube Kids. Nonetheless, the lack of guidance of an adult when using these platforms allows children to play the videos directly from the recommendations of algorithms that do not necessarily select what is of good quality instead of what is more appealing or trending (Covington, Adams & Sargin, 2016).

As studies have demonstrated, while within the television context the parental mediation is usually tighter over the content that the children watch, rather than over the time of exposure (Ponte, Simões, Batista, Castro & Jorge, 2017), in what concerns digital media the time of exposure is the primary concern, not the content. Furthermore, most parents of younger children believe that they are not exposed to risks while they are online since both their digital skills and practices are yet limited, and they do not use social media. Nonetheless, it is on YouTube, one of the favorite

and most used applications among younger children, that they can be exposed to inadequate or inappropriate content for their age (Dias & Brito, 2018).

In order to prevent the exposure to inefficient, inappropriate, or inadequate videos, we suggest that the families and kindergarten teachers make a previous selection of the educational videos to be shown to the children, compile them on a playlist, and only then let the children use the platform autonomously, from this playlist.

This procedure not only will guarantee that the children are exposed to good quality and effective educational videos but will also train the algorithms towards better content since the latter is based on a machine-learning process in which the use and the behavior of both users and creators influence the evolution of the algorithm (Covington, Adams & Sargin, 2016; Ribes, 2020).

2.2. THE DESIGN

In this second area, we intended to systematize the adequate characteristics of educational videos targeted at preschool children that make them engaging, adequate for the cognitive development of the viewers, and provide an effective learning environment. We divided this section into four categories:

- Formal characteristics
- Characters
- Language and communication strategies
- Educational content.

In the first category (formal characteristics), we intended to understand the relationship between the format and editing pace of audiovisual objects and the cognitive development of the children who consume them. In the second category (characters), we systematize how the choice of the characters and the cast influence explicit and implicit learning, both regarding the educational content and the acquisition of gender, ethnic, and social codes. In the third category, (language and communication strategies), we intended to understand how literal and non-literal language development occurs in children, especially regarding their comprehension skills. In the fourth category (educational content), we investigated the good practices in music education that can be transferred to educational videos.

Formal characteristics

The concerns about the effects of exposure to media on children have been recurrent since its emergence. Moreover, the concerns about the effects of technology shocks date back to Plato, who suggested that the introduction of writing would affect memory and, consequently, how we would experience the world (Postman, 1992).

As the literature suggests, when a negative social influence is attributed to something among minds that are more susceptible in times of instability and social change, this attribution gains a significant impact. Consequently, it can originate massive concerns, or “media panics,” that are shared on a broad scale (Ponte, 2012).

There is a recurrent public anxiety that arises from the possible harmful effects of the consumption of media by children (Messenger-Davies, 2010). Furthermore, the earliest scientific studies on children and media emerged in the late 19th and early 20th centuries, during the Progressive Era, in which the way children and adolescents spent their time was seen as a barometer of their health and welfare (Wartella & Robb, 2008).

The emergence of television arose strong media panics concerning several moral, social, and behavioral aspects. Some authors claim, for instance, that this medium caused the disappearance of childhood, destroying the golden era of family values and respect by exposing children to the world of adults before they are prepared for it (Postman, 1994). In addition, television and other screen media have been implicated in changes in mood and behavior by causing fearfulness, excitement, a decrease in the control of impulses and attention, and hyperactivity, among others (Comstock & Scharrer, 2012).

Similarly, other authors have pointed out that television and other media are responsible for disruptions to primary activities in which children are engaging, thus interrupting a sustained-attention process. Furthermore, they claim that chronic exposure to background media can negatively affect cognitive development (Anderson & Kirkorian, 2015).

Regarding the emergence of digital media, the media panics have been similar of ever more accentuated because while television broadcasting organizations and producers have to conform to laws and codes that regulate what content can or cannot be broadcasted and when, many digital products go beyond national regulation and frontiers (Messenger-Davies, 2010).

The time devoted to the use of media has been one of the major concerns since its beginnings, especially regarding the displacement of time that could be spent on

other activities (Wartella & Robb, 2008). The vast number of studies dedicated to the impact of time of exposure to media and its cognitive effects reflects these concerns.

On the one hand, the literature suggests that exposure to more than 2 hours per day in infancy and more than 3 hours per day in older children harms the development of attention and later behavior (e.g., Foster & Watkins, 2010; Parkes et al., 2013; Shiue, 2015). On the other hand, what children watch, more than how much time they spend in viewing, can significantly impact their cognitive development and behavior (Kostyrka-Allchorne, Cooper & Simpson, 2017).

Meeting the concerns of Postman (1994), studies suggest that exposing children to content created for an adult audience can negatively affect attention, behavior, and other cognitive outcomes since children learn social codes and behavior by observing others (Barr, Lauricella, Zack & Calvert, 2010; Mares & Kretz, 2015). Nevertheless, research on this topic has also demonstrated that children can effectively learn from audiovisual media when exposed to educational and age-appropriate content, and this learning can positively impact, in the long term, their academic skills and outcomes (Kostyrka-Allchorne, Cooper & Simpson, 2017).

Similarly to the importance of the content, the formal features of the program, such as format and editing pace, have a crucial role in determining whether the consumption of audiovisual media products can have a positive or a negative impact on the cognitive development, attention, and behavior of the children. Even though research on media and brain function is still rare and scarce, especially in what concerns brain development, neuroscience-based research, as well as research in the field of psychology, have already given valuable insights into this topic (Anderson & Kirkorian, 2015).

Animation vs. live-action format

In what regards format, animation is the most produced and broadcasted format within the history of programs for children since it is less expensive to produce than live-action (real image) programs and because it facilitates their exportation to

other markets, which makes them more appealing for the industry. Nonetheless, the literature suggests that this is not an adequate format for good cognitive development in children.

Evidence for this was presented by a study using functional magnetic resonance imaging (fMRI), conducted among 27 children with an average age of 4 years old. These children attended to stories presented in three formats: audio, audio with illustrated images, and audio with animation. While children were paying attention to the stories, the fMRI registered the activation of different brain areas and neural networks. The results suggested that the three formats mentioned above can be divided into “too cold” – audio-only, “just right” – audio with illustrated images, and “too hot” – audio with animation (Hutton, Dudley, Horowitz-Kraus, DeWitt & Holland, 2020).

On the one hand, according to these authors, the comprehension of the audio-only format (“too cold”) seems to require the creation of mental images that go beyond the experience that children have of the world, thus being a too demanding cognitive effort in processing the story. On the other hand, animation (“too hot”) seems to be too dynamic since the fast pace of the given stimuli and the lack of complexity in neural connections when processing them lead to a straightforward interpretation of what is being visualized. Thus, it can undermine the development of creativity. Finally, the audio format with illustrated images (“just right”), by combining the listened story with some visual cues, allows for the connection of multiple parts of the brain and the creation of mental images (Hutton, Dudley, Horowitz-Kraus, DeWitt & Holland, 2020), which are fundamental for the development of imagination and creativity.

Moreover, the animation format often comprises fantasy elements and scenarios that are harder to process cognitively, which can jeopardize the learning experience. Thus, taking these findings altogether, in what regards to educational videos for preschool children, live-action scenarios and characters are the best solutions.

The effects of fast-editing pace on attention and executive functioning

In this work, we consider the definition of editing pace as the rate at which there are changes between different scenes, whether they are new or familiar to the viewer. These changes are usually accompanied by visual or auditory features, such as fades, zooms, dissolves, and changes in music or sound effects (Wright et al., 1984).

A fast-editing pace is evident in features such as rapid shot changes and movement. The audiovisual industry often produces fast-paced programs to attract and hold the attention of children (Koolstra, Zanten, Lucassen & Ishaak, 2004).

The efficiency of visual action in attracting and retaining attention can be explained from an evolutionary perspective since the need of primitive humans to quickly identify predators in the wild has left a vestige on how human attention evolved (Pratt, Radulescu, Guo, and Abrams, 2010). As explained previously in this work, the human brain constantly tends to pay attention to new stimuli and fall asleep in their absence. Thus, fast-paced programs with several different stimuli are more efficient in recruiting and retaining the attention of children (Fisch, 2017).

Nonetheless, this is not valid for all children since studies have demonstrated that school-age children, for instance, often use scene changes as attentional decision points, in which they start and stop looking at the screen. Therefore, a rapid pace may cause attention-shifting instead of a desired longer looking (Wright et al., 1984). In what regards to educational videos, this means that fast-paced programs can be ineffective in retaining the attention of the children to the educational content.

Research on the effects of consumption of fast-paced products has not yet produced clear results (Kostyrka-Allchorne, Cooper & Simpson, 2019). Nonetheless, some studies on attention and media suggest that systematic exposure to fast-edited videos causes attention-deficit-like symptoms in younger viewers in the short term. This can shorten the attention span of the viewers and hinder the development of sustained attention (Anderson & Kirkorian, 2015; Christakis, Zimmerman, DiGiuseppe & McCarty, 2004; Kostyrka-Allchorne, Cooper, Gossmann, Banks & Simpson, 2017).

Moreover, a fast pace can affect both the comprehensibility and the ability to recall the content, especially in what regards young children (Wright et al., 1984). In what concerns educational programs, this can be another crucial aspect in determining whether they can be an effective or ineffective learning tool.

Other studies have related the exposure to face-paced programs with an immediate impairment on the executive function (EF) of young children, namely in what regards the inhibitory control (Kostyrka-Allchorne, Cooper, Kennett, Nestler & Simpson, 2019).

The EF skills encompass working memory (the ability to retain information in mind to complete a task); inhibitory control (the ability to refrain from impulsively doing something that is not compatible with the task which is being performed at the moment); set-shifting (the ability to switch between two tasks that compete for attention); self-regulation (the ability to modulate emotions and regulate them); and decision-making (Linebarger, Brey, Fenstermacher & Barr, 2017).

In addition, the literature points out that there are two types of EF, namely “cool EF,” which is related to non-emotional decision-making, and “hot EF,” which is related to emotional decision-making and self-regulation when facing tempting rewards or situations. These skills are crucial for school readiness (Huber, Yeates, Meyer, Fleckhammer & Kaufman, 2018).

Taking these findings altogether, the literature suggests that a slow to moderate editing pace is the best solution in what regards educational videos for preschool children.

Characters

The presence of characters and dialogues between them in educational videos is paramount for enhancing learning since the literature suggests that children tend to pay more attention to people and puppets talking on the screen than to objects (Flynn, Wong, Neuman & Kaefer, 2019). This is because faces and face-like configurations provide attentional and emotional cues that make them relevant to children (Kirbas &

Smith, 2019). In addition, the human or human-like presence is fundamental for increasing the sense of social presence and maximizing learning outcomes (Pi, Hong & Yangt, 2017).

During or after a “window of opportunity”, the key to learning is social interaction (Blakemore & Frith, 2009). Thus, the image of the characters, their facial expressions and gaze increase the sense of the learner of belonging to a social context and being in a social presence. Activating his/her social response enhances the learning experience (Pi, Hong & Yangt, 2017).

Moreover, young children tend to imitate the behavior of the characters they watch, especially when they are interesting and relevant (Bandura, 1965; Linebarger & Piotrowski, 2010). Consequently, choosing an appropriate cast is one of the most critical challenges for achieving appealing and efficient educational videos.

Characters and learning

Just as children learn best from their favorite teachers at school, learning can be facilitated when the characters on educational videos are engaging and beloved by the viewers (Calvert, 2017). Nevertheless, these characters must meet some requirements in their design and forms of participation in the videos so that children can learn from them.

An important factor to consider when designing the characters is that how young children perceive them can influence learning from educational videos. Trust, identification, and social realism are key factors in maximizing learning outcomes (Schlesinger, Flynn & Richert, 2016).

To begin with, trust has been related in the literature to higher comprehension levels and better transfer of learning (Schlesinger, Flynn & Richert, 2016). As children depend on others for information that they cannot have by themselves, in early childhood, whom they trust is strongly related to whom they are attached. Nonetheless, by preschool age, they can already discriminate who or what provides them reliable information and who or what does not, and their trust shifts towards the

source of accurate information, whether it is familiar to them or not (Calvert, 2017). This influences the attention and the cognitive effort they put into the information they receive, and it occurs not only in physical social contexts with other people but also in media contexts with characters (Richert, Robb & Smith, 2011).

Characters that children perceive as being trustworthy usually display expertise in general or in a particular domain, always present reliable information, and are successful in attempting to solve a problem. Thus, the literature suggests that displaying expertise is a good strategy to achieve reliable characters that can enhance learning from videos (Schlesinger, Flynn & Richert, 2016).

In what concerns identification, when the children feel that a character is similar to themselves, they feel more easily connected to the videos and invest emotionally more in them than when they do not feel this resemblance. Thus, identification can facilitate learning (Fisch, 2013b; Richert, Robb & Smith, 2011). In addition, from preschool age on, children usually have greater identification with characters that are of the same gender as them (Calvert, 2017; Schlesinger, Flynn & Richert, 2016). Therefore, it is important to include a diverse cast to provide variability and encourage identification (Fisch, 2013b).

When trust and identification are achieved, the children experience a sense of social connectedness that fosters learning. This is facilitated by activities that uphold the sociocultural identity of the viewers rather than trying to adjust them to another culture (Calvert, 2017). Thus, it is paramount to consider the sociocultural contexts of the target audience in what regards educational videos for children so that they can relate to what is presented on the screen.

Social realism refers to the belief that a character exists or is similar to people who live in the physical world (Schlesinger, Flynn & Richert, 2016). Even though it is still difficult for preschool children to separate reality from fantasy, several of them are already capable of distinguishing what can or cannot happen in the physical world, and they start from this distinction to select the most reliable sources of information, similarly to what occurs when they select who or what characters to trust (Richert, Robb & Smith, 2011).

Regarding the positive influence of social realism on learning from videos, studies have demonstrated that it is more related to the engagement of the characters in realistic activities rather than if they are animated or real characters. Thus, the literature suggests that it is not relevant if the character is animated or not for being perceived as real, as long as what they do can happen in the physical world (Schlesinger, Flynn & Richert, 2016).

In addition, social realism can be enhanced by connecting a character to the surroundings of the child (e.g., family, pets, friends, etc.) through joint interaction. This strategy can help children connect the learning experiences in the different media platforms and the physical world, thus facilitating the transfer of learning (Brunick, Putnam, McGarry, Richards & Calvert, 2016).

Social realism is also one of the main factors that compose parasocial relationships with media characters, which are fundamental for enhancing learning from educational media. In other words, children who establish a parasocial relationship with a media character believe that it exists outside the media, which facilitates learning (Brunick, Putnam, McGarry, Richards & Calvert, 2016).

The term “parasocial relationship” derives from the concept of “parasocial interaction,” which is a unilateral (or one-sided) form of social interaction between the viewers and a media character (Richards & Calvert, 2017). Some examples of parasocial interactions are when the characters look at the camera and ask questions to the viewers, invite them to participate, pause to allow them to answer, and give feedback on possible answers (Calvert et al., 2019). When parasocial interactions are extended in time and occur within multiple platforms or contexts, a parasocial relationship emerges (Liebers & Schramm, 2019).

Besides social realism, parasocial relationships are characterized by two other factors: attachment and character personification. Regarding attachment, it occurs when a child experiences a feeling of safety and comfort in the presence of a character (Brunick, Putnam, McGarry, Richards & Calvert, 2016). To achieve a feeling of attachment, the literature suggests that when a character is computer-generated, it is crucial to consider its design since viewers in general, and especially children, tend to

experience a strong discomfort and disgust when characters display human features that are too realistic (Mori, MacDorman & Kageki, 2012).

Conversely, young children often love and feel attached to characters that are less realistic and resemble more a cartoon, with visual features such as oversized eyes and neotenous traits (Brunick, Putnam, McGarry, Richards & Calvert, 2016). As they grow up, children tend to abandon the preference for baby-like characters and tend to prefer those that act and look more mature but are still not too realistic (Calvert, 2017).

Concerning character personification, it refers to the perception of the child that a character is like a person, thus making it socially relevant. The literature suggests that introducing human-like emotional capabilities, needs, and wants in the characters, as well as sensitive social contingent responses to children, is a good strategy for character personification (Brunick, Putnam, McGarry, Richards & Calvert, 2016).

Social contingency comprises conversational features such as timing and response personalization. It is a paramount factor for learning from educational videos because it provides social cues that are present in the social interactions within everyday life, which aid children in learning (Richards & Calvert, 2017). Turn-taking, for instance, which is a form of social contingency, is one of the first conversational rules that infants become aware of, learning that within a social interaction, it is necessary to fill the turn of each participant, passing it on to the next participant and waiting to participate again (Sim-Sim, 1998).

Furthermore, an ideal contingent interaction occurs when a character processes and responds to the self-disclosures of a child with adequate conversational timing and in a manner that makes the interaction advance meaningfully (Brunick, Putnam, McGarry, Richards & Calvert, 2016).

Considering these factors altogether, when children form parasocial relationships with media characters, they feel attached to them, believe that they exist outside the media, and perceive them as being like humans, with human features, wants, and needs. This facilitates learning because the characters with which children

form parasocial relationships become socially meaningful to them and can have a similar social role as a human (Calvert, 2017).

Furthermore, children learn best from characters with which they have parasocial relationships because when the viewers are familiar with the characters onscreen, trust them and perceive them as socially meaningful, additional working memory resources are freed up for the comprehension of the educational content, instead of the processing of who the character is (Richards & Calvert, 2017)

Hence, parasocial relationships should be fostered, and the literature suggests three factors that can influence the development of this type of relationship: toy engagement, parent scaffolding, and repeated media exposure (Bond & Calvert, 2014).

Regarding toy engagement, the literature suggests that playing with toy versions of media characters and nurturing them can promote parasocial relationships, whether they are plush toys, puppets, or interactive toys. Children attempt to respond to the perceived needs of these toys while playing, and this fosters attachment to them and close relationships (Brunick, Putnam, McGarry, Richards & Calvert, 2016). As several studies have demonstrated, emotionally close relationships with the toy versions of the characters result in better performances when children engage in onscreen activities demonstrated by their media versions (Calvert, 2017).

Regarding parent scaffolding, characters must be attractive both to the children and the parents (or other caregivers) since the latter can encourage both parasocial relationships and learning through scaffolding and joint attention (Brunick, Putnam, McGarry, Richards & Calvert, 2016).

Finally, in what concerns repeated media exposure, the literature suggests that parasocial relationships can be fostered by repeated exposure to the characters across different platforms. Moreover, the existing parasocial relationships can unite the platforms on which the characters appear, such as computers, tablets, mobile phones, and television (Richards & Calvert, 2017). Nonetheless, this type of relationship only emerges from repeated exposure if it promotes parasocial interactions on all the platforms (Brunick, Putnam, McGarry, Richards & Calvert, 2016).

Similarly, an alternative form of emergence of parasocial relationships is from watching the interactions between two or more characters on screen, talking to one another side by side. This theory is in line with the Social Learning Theory (or Social Cognitive Theory), which posits that children learn new behaviors by observing how others behave and interact socially, whether they are live models or media characters (Bandura, 1965; 2009; Richards & Calvert, 2017).

Cast and stereotypes

As mentioned previously in this work, educational videos can contribute not only to explicit learning but also to tacit knowledge, or implicit learning, which encompasses the learning of cultural codes. Thus, they can contribute to shaping how children perceive the world, influencing their behavior, and widening or disrupting their mental schemata. In what regards to characters, by presenting a diverse cast, it is possible to vary the cultural experience of the children, thus lowering the possibility of stereotypes being crystallized.

Gender stereotypes, for instance, which are defined in the literature as a set of beliefs about the characteristics or attributes of a particular group that differentiate it from the others, promoting a distinction between men, women, boys, and girls, are something with children come into contact irrespective of the values transmitted by family, since the media and the interaction with peers, especially at school, expose them to certain messages about gender (Halim & Ruble, 2010).

The literature suggests that several power institutions, from governments to institutions of religious nature, systematically validate gender categorization in societies. Therefore, it is necessary to adopt an active attitude of non-acceptance and challenge these patterns (Grieshaber & Yelland, 1998). This can be especially relevant when creating and presenting content for children.

At about two years old, children learn the gender differences usually associated with adults: physical appearance and the roles played in various social contexts. At around two-and-a-half years old, children demonstrate that they are aware of gender

stereotypes evident in most children toys. By the age of five, children show greater flexibility in what concerns gender stereotypes regarding personality traits, associating characteristics such as being “gentle,” “daring,” or “adventurous” to different groups. When children between 5 and 7 years old are asked to give spontaneous descriptions of boys and girls, the latter are often described based on their physical appearance, including descriptions of how girls dress, how they wear their hair, make-up, and perfume. In turn, boys are associated with behavioral and personality traits, such as fighting, bravery, and a preference for action games. Finally, from age 7 onwards, the inflexibility regarding gender stereotypes gives way to greater flexibility and the predominance of the use of specific information, as opposed to using stereotypes when describing a stranger. Nevertheless, throughout childhood and adolescence, the dissipation or consolidation of gender stereotypes is largely influenced by the cultural contexts of the children (Halim & Ruble, 2010).

This is where programs for children can play a crucial role, not only in what regards gender but in all kinds of stereotypes (Mares & Kretz, 2015). Nonetheless, the audiovisual industry often undervalues this potential. Studies have demonstrated that only 32% of the main characters in programs for children worldwide are female; 72% are Caucasian; less than 1% have some kind of physical disability or chronic disease; most of them live in a middle or upper-class context; there is little representation of migrant communities; the dominant values are occidental; and there is little diversity in depicting the concept of family (Basílio, 2018).

Furthermore, in what regards to animation, for instance, the literature suggests that there is still a stereotypical emphasis on female hypersexual appearance, wearing revealing clothing even in programs targeted at young children. In addition, while female characters are often depicted as passive, emotional, vulnerable, and dependent, male characters are rational, active, and brave. Regarding production codes, programs aimed at boys usually present quick camera cuts, blue and dark colors, and a loud audio track, while programs targeted at girls often use soft camera filters, pastel colors, and melodic music. Regarding the merchandise derived from the programs, it is not unusual to find toys, games, and accessories that reinforce these gender stereotypes (Lemish, 2020). Hence, there is still a long way to go.

Language and communication strategies

As explained previously in this work, comprehension is a paramount factor for learning because what is not comprehended is not processed by the working memory nor stored in the long-term memory. In other words, what the learner does not understand, he/she does not learn. Therefore, in this section, we intended to investigate the adequate complexity of the language to be used when producing educational videos.

We begin by reviewing the expected level of receptive language skills in preschool children regarding literal language. Secondly, since learning from educational videos is in its nature a social experience, and social interactions often encompass humor and irony, scriptwriters often imitate in their dialogues the way of speaking of their audiences. Nonetheless, not all audiences can understand or appreciate non-literal utterances (Lozano, 2017). Thus, we systematize the expected comprehension level of these types of non-literal language.

The development of the receptive language skill

The receptive language skill is the ability to understand and comprehend what is heard or read. Its development is dependent on several factors, such as age and the sociocultural environment of the children, and it is related to their socioemotional development (Rose, Weinert & Ebert, 2018). Similarly to other cognitive skills, children develop the receptive language skill from the stimuli they receive from their sociocultural environments (Blakemore & Frith, 2009).

Before children begin to speak, they firstly communicate by cooing and babbling (within the first seven months of age) and then by gesturing (which emerges around the end of the first year of life, along with the emergence of the first words). The use of gestures indicates that children understand language before producing it. Comprehension comes before the production of language throughout the entire process of language development since the latter is closely linked to cognitive development (Duchesne & McMaugh, 2016; Sim-Sim, 1998).

Cooperation and prosocial engagement are the foundation of human communication, even before language. The literature suggests that this is because individuals who engaged with one another collaboratively at some point in human evolution were at an adaptative advantage. Thus, the need for social engagement to request or give help or information and share attitudes or feelings motivated the emergence of simpler and more primitive forms of communication than language, such as pointing and pantomiming. These forms are not conventionalized nor coded. Humans have used them throughout the times to direct the attention or the imagination of another human or recipient toward something that is immediately present in the environment (in the case of pointing) or that is immediately absent but imaginable (in the case of pantomiming) (Tomasello, 2008).

Besides cooperation, sharing a common ground (or context) is fundamental for human communication (Clark, 1996). This is because only when the recipient knows why the communicator is directing his/her attention or imagination toward an element, he/she can understand the communicative intention and respond accordingly. The common ground can be based on shared experiences from the past, in common cultural knowledge, or in the immediate perceptual environment (in this case, it is named joint attention since the attention is being shared or paid jointly) (Tomasello, 2008).

Joint attention is paramount for language development because children learn vocabulary more rapidly when parents or other caregivers label the elements in the immediate perceptual environment for them. Some studies have demonstrated that when children and their caregivers engage in joint attention dynamics, children direct the attention of the labelers to what is relevant for them in the environment, thus keeping the learning experience interesting and making sense to them (Duchesne & McMaugh, 2016).

Most children learn to speak around two years old, and by six years old most of them already know the entire phonetic system of their native language, its grammar structure, and have a vast vocabulary (Blakemore & Frith, 2009).

Usually, children begin by producing single words that are easy to pronounce and use as phrases. These “holophrases,” similarly to gestures, are used to make requests or describe things (Tomasello, 2003). In addition, in this stage, children usually form simple questions, such as “what” and “why,” and produce simple forms of greeting and farewells. Around the end of the second year of life, children usually form two-word sentences, though disregarding tense, gender, and number, since these concepts evolve along with cognitive development. At the beginning of preschool age (about three years old), children begin to form three-word sentences in the word order of their native language, and the extension of the sentences increases with age and cognitive development (Duchesne & McMaugh, 2016).

It is important to notice that the development of language skills is not equal for every child since it depends on the stimuli the children are given within their first years of life and their cognitive functioning, among other factors. Nonetheless, since the receptive language skill develops before the production (or expressive) skill, it is expected that children understand several more words and sentences they hear before producing them.

Bearing this in mind, the exposure to a broad vocabulary from a young age increases vocabulary knowledge, which is related to better literacy skills and reading achievement when children enter school (Danielson, Wong & Neuman, 2019).

The literature suggests that some strategies can enhance both receptive and expressive language skills. These strategies are child-direct speech (which is a type of speech that tends to be higher in pitch, to have simple grammar and vocabulary, and to be produced with an exaggerated expression); expansion and recasting (that consists in repeating what the child said and expanding that utterance with more information); language input (which refers to the exposure of children to several different words within a direct instruction context); language play; and peer interaction (Duchesne & McMaugh, 2016).

Furthermore, research on vocabulary intervention has presented evidence that educational media has the potential to provide great opportunities for young children to increase vocabulary knowledge (Fisch, 2013b). Therefore, besides teaching

educational content, videos targeted at preschool children can also foster the development of language skills and vocabulary growth, as long as their production encompasses specific pedagogical strategies similar to those previously mentioned in this chapter (please see “The Discourse”).

The screen-based pedagogical supports are divided into three categories, namely (1) definition, (2) picture support, and (3) attention-directing. In what regards to definition, the literature suggests giving explicit definitions, discussing features, and providing examples. In what concerns picture support, it is recommended to provide visual effects and use props. Regarding attention-directing strategies, it is suggested to use verbal and pointing cues, sound effects, humor, repetition, and “guess target word” activities (Danielson, Wong & Neuman, 2019).

The exposure of preschool children to sophisticated words in a repeated and systematic manner (without presenting too many novel words at once) can foster a better vocabulary performance when they reach elementary school (Danielson, Wong & Neuman, 2019). Nevertheless, studies have demonstrated that in most videos targeted at preschool children, the dialogues are mostly based on words that match the language used in daily interactions with children (Danielson, Wong & Neuman, 2019; Rice, 1984).

Therefore, when creating educational videos for preschool children, it is important to include a diversified vocabulary in the scripts, as long as the cognitive processing of novel words does not interfere with the learning of other educational content.

Communication strategies – the use of humor and irony

What we say, to whom we say it, and how we say it varies according to the circumstances. These multiple uses of language in social contexts are investigated by a field named Pragmatics, and studies in this field have demonstrated that the development of communicative skills develops along with cognitive development, and often later than literal language. The comprehension and production of non-literal

language require that children already master the structural domain of their native language, and this does not fully occur before school age (Sim-Sim, 1998).

As previously mentioned in this work, the use of non-literal language on videos is important for simulating real social interactions, which, in turn, are crucial for learning from videos. Nonetheless, many scripts targeted at preschool children are written by scriptwriters who do not always consider the comprehension skills of their target audiences. They often use communication strategies for achieving a supposedly more engaging script that does not result as expected. This is the case of humor and ironic remarks, and we systematize the development of such comprehension skills here.

The use of humor in educational videos targeted at preschool children

The use of humor can enhance the learning experience by promoting an environment of positive emotions. Both the motivation and the expectations of the learners, especially children, can differ considerably between the classroom environment and educational videos, and this difference can influence their attention and the learning outcomes. This is because while the classroom is perceived as an environment of knowledge acquaintance, educational videos compete directly with entertainment-only objects, so they need to be sufficiently entertaining to retain the audience. Thus, while humor is an efficient strategy within the classroom to combat inattentiveness and promote an enjoyable learning experience, its use in the educational video environment is fundamental to ensure that the learner does not abandon the audiovisual object (Zillmann & Bryant, 2013).

Based on several studies focusing on humor and educational videos, some authors suggest that its use has beneficial effects, whether related or unrelated to the educational topic. Moreover, it should be distributed dispersedly throughout the learning episode, be vivid in its visual and auditory presentation, and not presuppose knowledge that the children may not have (Zillmann & Bryant, 2013).

When producing educational videos for preschool children, it is important to consider what young children perceive as humor, or better, what types of humorous content they appreciate. Therefore, to understand this, it is paramount to know how humor develops throughout childhood, from birth to preschool.

Humor derives from the perception or evocation of a funny event. Its primary component is incongruity, i.e., the occurrence of elements usually expected to be incompatible. As such, humor is strongly related to mental schemas since smiling or laughter occurs when there is a momentary imbalance between the schemas of who experiences the funny situation. Nonetheless, it is important to notice that this imbalance is also present in situations of perplexity and fear, for instance. Thus, humor relies on specific social cues to be cognitively perceived as such. These cues help confirm the intention of provoking a positive emotion and are particularly important for children three or four years old. For children this age, the notion of reality is still very vague and uncertain, and both the incongruities and the humorous intent of presenting them can be challenging to understand, resulting in a bizarre and frightening experience instead of a funny one (Bariaud, 2013).

The literature suggests that after the first phase of imbalance, or contradiction, between the expectations of the receiver and what he/she experiences, there is a phase of reconciliation between these elements, i.e., a resolution that explains and justifies the incongruity (Shultz, 1972). Both incongruity and resolution components are fundamental to the humor experience (Bariaud, 2013).

Humor is a cognitive experience strongly dependent on cognitive development (McGhee, 1979). In order to appreciate humor and the incongruities it entails, it is necessary to know the referents it distorts. Therefore, the degree of humor appreciation and production is dependent on the degree of knowledge of the physical world, the social norms, the language rules, and the development of more complex cognitive processes, such as the formation of concepts and logical operations, among others (Bariaud, 2013).

It is claimed in the literature that the development of humor is tightly linked to the stages of cognitive development of Piaget (see McGhee, 1979). As previously

mentioned in this work, Piaget defines four stages of development, namely the sensorimotor stage (from birth to 2 years old), the preoperational stage (between 2 and 7 years old), the concrete operational stage (between 7 and 11 years old), and the formal operational stage (from 11 years old until adulthood). In the first stage (0-2 years old), the main achievement is to form a mental representation of an object, thus knowing that it exists, even if not present. In the second stage (2-7 years old), although children can think symbolically, their viewpoint is egocentric (Wadsworth, 2004).

Within the second stage, at about three years old, children begin to understand that words can refer to categories of objects that share common features rather than a single object (Bariaud, 2013).

In the third stage (7-11 years old), the child begins to think logically and operationally, which means that he/she can perform more complex cognitive operations without a physical object. Finally, in the fourth stage (>11 years old), the child can think and understand abstract concepts and test hypotheses through logic (Wadsworth, 2004).

Since the appreciation and production of humor in children follows the stages of their cognitive development, up to two years old, it is expected that children appreciate and produce humor that is based on pretend play behaviors. This is because it is only when language emerges (usually from 2 years old on) that the child begins to appreciate and produce incongruences based on it, often by mismatching labels for objects or actions (Bariaud, 2013).

The emergence of language marks the beginning of a new stage, in which the children begin by playing with the words they already master, misnaming things on purpose (usually until they are 3 or 4 years old). During preschool age (between 3 and 5 years old), children tend to experience enjoyment from playing with the phonetics of the words and making nonsense combinations of them. In the same period, since children from 3 years old on can think conceptually in what regards categories (namely shared and distinctive attributes – e.g., the concept of “dog”; all dogs bark and not one specific dog; a dog does not look like a cow; etc.), they begin to appreciate the distortion and violation of the normal attributes of an object. Therefore, the literature

suggests some examples of humor that amuse preschool children: adding features to something that does not belong there (e.g., a man with a head of a dog), or removing them (e.g., a car without wheels); changing the shape, size, and color of an object (e.g., a man with a square head); exaggerating and misplacing features of something (e.g., a man with a very long neck); and showing incongruous or impossible behavior (e.g., a cow whistling like a bird) (McGhee, 2002). Finally, mishaps and pranks, resulting from foolishness or mischievousness, are forms of humor that young children also appreciate due to their decoding ease (Bariaud, 2013).

Using verbal irony as a form of humor

One of the most used forms of humor among adults is verbal irony, and the literature suggests that speakers who make ironic remarks are perceived as being funnier than those who do not (Pexman, Glenwright, Krol & James, 2005). Thus, several scripts written for educational programs for children include irony as a form of humor, aiming to engage their audience. Nonetheless, this is a risky option that can jeopardize learning since not all children can understand it (Zillmann & Bryant, 2013).

Irony is a figure of speech that can be defined as a non-literal utterance that requires the sharing of a common ground to be understood, has a teasing aspect, and is based on an unexpected incongruity (Angeleri & Airenti, 2014). Through it, additional meaning can be conveyed within a discourse, and by using it, the speaker may achieve multiple social and communicative goals, such as muting the aggression of criticism or tempering the positivity of a compliment (Harris & Pexman, 2003).

This figure of speech is one of the examples that Grice classified as a flouting of the Quality Maxime of the Cooperative Principle, which implies that the contributions to the discourse should be clear and genuine. Nevertheless, if the speaker deliberately flouts a maxim, he/she intends for the listener to infer why he/she flouted it, suggesting a conversational implicature (Grice, 1989). To understand irony is necessary to infer the intention of the speaker, and this ability is not developed until the age of seven (Loukusa & Leinonen, 2008; Pexman & Glenwright, 2007).

As some authors claim, the ability of children to grasp the meaning of verbal irony depends on their mentalizing skills, social learning, and neural maturation, and these skills are dependent on their social and cognitive development. Only through social experience does the perceiver acquire the knowledge of non-literal language in general and teasing in particular. In addition, the prefrontal cortex, which is strongly implicated in irony comprehension, develops later than other structures in the brain. Since it is not matured yet in childhood and continues to develop into adolescence and early childhood, it may also contribute to individual differences in irony comprehension and a wide window of opportunity in what regards this skill (Pexman & Glenwright, 2007).

The literature suggests that there are two levels of irony comprehension: first-order beliefs, which stand for the detection of incongruity or falsehood – i.e., the inference of what the speaker believes; and second-order beliefs, which are related to the inference of the intention of the speaker (Angeleri & Airenti, 2014). Therefore, a child must be able to understand what is the belief of the speaker (if the speaker is telling the truth or not) before he/she can determine the intent of the speaker (why did the speaker choose to use irony) (Harris & Pexman, 2003).

As several studies have demonstrated, children at the age of four can already detect irony as a first-order belief, or an incongruity, but most of them can only detect the intent of the speaker, or the second-order belief, only at the age of six (Angeleri & Airenti, 2014; Banasik, 2013; Loukusa & Leinonen, 2008; Pexman & Glenwright, 2007). Furthermore, even when children of 5 or 6 years old can understand the intent of the speaker, they do not appreciate the ironic utterances as funny since they are only beginning to share the perception of adults that irony may be funnier than literal remarks. Moreover, children tend to identify themselves as the victims of ironic criticisms and have difficulties in dealing with conflicting representations of intentions and emotions (Pexman, Glenwright, Krol & James, 2005).

Therefore, even though the development of non-literal language and pragmatics may vary across cultures (Küntay, 2012; Filippova, 2014) and some children may appreciate ironic utterances differently than others, this form of adult humor should be avoided generally in educational videos targeted at preschool children.

Educational content

As previously mentioned, this work aims to create, produce, and distribute a pilot episode of an educational series about music education targeted at Portuguese preschool children, within the scope of the applied research part (Part II). Therefore, the literature reviewed here focused on the music curriculum appropriate for preschool children and the good pedagogical practices that can be transferred to video.

To begin with, it is important to mention that learning music does not only mean learning how to play an instrument, sing, or read a score. When designing a music curriculum for children, it is important to consider that its goal should be to train independent musicians and musical thinkers, who should develop the ability to audiate music, to sing in tune, to move in a coordinated manner, and to perform (Bluestine, 2000).

Audiation is a concept developed by Edwin Gordon within the Music Learning Theory (Gordon, 2000), and audiating means the ability to hear and understand music when the sound is no longer present or has never been (e.g., when recalling music from memory, when reading a score, and when improvising, reading, or composing music without playing an instrument) (Caspurro, 2007). Audiation cannot be taught, but children can learn how to do it (i.e., to understand music), and it is the ground for music aptitude, i.e., the acquisition of music skills that derive from learning (Gordon, 2000).

The literature suggests that children acquire music skills in a similar manner than they learn their native language: firstly, they must be exposed to and hear music, then they should learn to perform, and only then they should learn how to read and write music, following a sound-before-sight-before-theory sequence (Bluestine, 2000).

Similarly to the existence of a “window of opportunity” in language development, both the ability to audiate music and music aptitude have a critical period for development in the first years of life. Thus, it is paramount to expose children to musical stimuli within this period (Rodrigues, Rodrigues & Rodrigues, 2016).

The Music Learning Theory claims that to understand, anticipate, and predict music (audiate), children must first acquire a set of tonal and rhythmic patterns (i.e., the smallest music unit that can be perceived from the tonal or rhythmic structure of a musical work). Just as letters form words and words form sentences, brief sequences of notes with different pitches or duration form music patterns, which in turn form musical sentences. Thus, the wider the pattern vocabulary a child possesses, the higher the probability of making sense of music (Caspurro, 2007).

The acquisition of this vocabulary should be facilitated firstly through informal guidance (i.e., activities that promote listening, singing/chanting, moving, audiating, and improvising) and only later through formal guidance (i.e., activities that promote reading and writing), the latter from 5 years old on (Gordon, 2000).

Similarly to what occurs in the language learning process, age and cognitive development play an important role in determining the “readiness” for acquiring specific musical skills (e.g., reading music notation) (Caspurro, 2007; Mursell, 1958). Just as cognitive and language development occur throughout different phases and stages, there are seven stages for the development of audiation in preschool children (“preparatory audiation”)², through which they pass if exposed to appropriate musical stimuli. According to the Music Learning Theory, these stages can be grouped into three types: acculturation (from birth to 2-4 years old – stages 1-3), in which children engage with little consciousness of the environment; imitation (from 2-4 to 3-5 years old – stages 4-5), in which children engage consciously, focusing primarily on the environment; and assimilation (from 3-5 to 4-6 years old – stages 6-7), in which children engage consciously, focusing primarily on themselves (Gordon, 2000).

Music learning (just as language learning) starts essentially from a social learning experience that begins with the interactions between parents (and other caregivers) and babies and continues throughout childhood and beyond. These interactions presuppose absorbing the musical stimuli from the environment,

² The seven stages of preparatory audiation: (1) Absorption; (2) Random response; (3) Purposeful response; (4) Shedding egocentricity; (5) Breaking the code; (6) Introspection; and (7) Coordination (Gordon, 2000).

responding to them (by imitation, repetition, exploration, and improvisation), and being given a further response (Valerio, Reynolds, Bolton, Taggart & Gordon, 2000).

These interactions require proper contingent response timings, just as in conversational turns, which means that this represents an additional challenge when creating and producing educational videos for preschool children about music education. This is because the creation and production of this type of object must consider not only the limitations of the medium for learning and how to overcome them (by using specific cognitive and pedagogical strategies, selecting the appropriate characters, and language adequacy, among others), but also which contents of the curriculum can be conveyed by audiovisual objects.

For instance, educational videos that focus on language development can teach vocabulary, as mentioned previously in this work, but it is highly improbable that they alone can teach how to speak. Likewise, educational videos that focus on music education can foster exposure to tonal or rhythmic patterns, for instance, but they cannot teach how to understand or make music from them.

Taking these aspects altogether, building an adequate music curriculum for educational videos targeted at preschool children should start by acknowledging which skills it should address and which components can be transferred into video format.

The first thing children must be able to do before engaging in musical activities is to listen clearly and accurately (Schafer, 1967). Therefore, raising awareness of the importance of listening to the surrounding environment is an appropriate topic that can be conveyed by videos targeting young children.

Another topic that can be covered in educational videos about music education is the properties of sound, such as dynamics, style, and timbre, since they do not need to be sequenced in learning hierarchies (Bluestine, 2000). Furthermore, this is one of the curriculum topics that the Portuguese Directorate-General for Education (Direção Geral de Educação) recommends being covered in music sessions for preschool children, suggesting pedagogical activities such as (1) identification of sounds of nature (animals, thunderstorms, the rain, the sea, among others), (2) identification of everyday sounds within the cultural context of the children (buses, trains, cars, planes,

ringing bells, among others), (3) identification and reproduction of loud and soft sounds, and long and short sounds, (4) identification of different music styles, (5) identification of different musical instruments, and (6) learning and reproduction of short and simple songs (Silva, Marques, Mata e Rosa, 2016).

2.3. THE PRODUCTION

Regarding this area, we intended to investigate adequate techniques and strategies for recording, editing, and producing engaging and effective audiovisual objects for preschool children. We divided the area into the following topics:

- Speech pace
- Intelligibility
- Quality, media diversity, and congruence.

These topics correspond to the critical aspects that producers must consider for achieving efficient educational videos (Lange & Costley, 2020). Thus, in this section, we develop each one individually, focusing on the particularities of the preschool target audience.

Challenges for producing engaging and efficient educational videos

Producing educational videos for preschool children is different from producing for older target audiences because children do not process the video content in the same manner that older viewers do, as explained in previous sections.

Thus, the literature points out that when producing this type of object for young children, the visual production features should comprise a moderate level of action (at about the speed of a walk) and should prioritize the use of long slow zooms within the same scene instead of cuts, since cuts require a higher cognitive effort to process in order to fill the gap they create mentally. Nevertheless, in some circumstances, the use of cuts is unavoidable; in these cases, editors should use dissolves between scenes (Calvert, 2017).

Cuts allow the transition between different settings, the compression of time and space in a narrative, and the presentation of different viewpoints over the same subject or object, which can make the videos more engaging and retain the attention

of the viewers for a longer time. However, when producing videos for preschool children, these different perspectives should be combined with caution, as this section will explain further.

In what regards to the audio production features, the videos must comprise songs since singing can elicit an automatic response from the auditory rehearsal loop, which can enhance the cognitive processing of the educational content. In addition, characters should have a theme song representing them and the program (Calvert, 2017).

Regarding the use of background music, studies with infants have demonstrated that when music does not provide meaningful information (opposite to when it is used as an element for eliciting attention, for instance), it creates an additional cognitive load and undermines the processing of other information (Barr, Shuck, Salerno, Atkinson & Linebarger, 2010). Although it is still unclear if the same applies to preschool children, background music should be used cautiously in videos targeted at them.

As mentioned in this work, learning from educational videos requires the cognitive processing of the learning content by organizing the information received through both the visual and the auditory channels. Thus, learning strongly depends on how the videos are delivered to the learner. When media are used ineffectively, the engagement, interest, motivation, and comprehension of the learner can be affected, thus jeopardizing the learning experience (Mayer, 2014b).

For instance, research on engagement with e-books and children has demonstrated that screen size can influence a cluster of engagement behaviors. This is the case of larger touch screens, that can be less supportive of multi-sensory behaviors (touching, for instance), and require the aid of an adult to enhance the learning experience (Roskos, Burstein, Shang & Gray, 2014). Therefore, the displaying conditions of educational videos may affect learning from them.

Bearing this in mind, it is paramount that producers consider some critical aspects in the production of efficient educational videos, namely: adequate speech pace (the rate of speech at which the educational content is presented), intelligibility

(the quality of the video of being accurately seen and heard, thus easily perceived and comprehended), quality (by achieving an appealing appearance, bearing in mind aesthetics and production values), media diversity (by presenting the educational content through different types of media), and congruence (by having a connection between those different sources of information, i.e., visual and auditory information) (Lange & Costley, 2020).

Speech pace

Regarding speech pace, when it is too fast, learners tend to experience difficulties in comprehending the content. Conversely, when the speech rate is too slow, the learners may feel disengaged and shift their attention to other stimuli (Koumi, 2013).

The adequate speech rate can vary among learners of all ages. Nonetheless, choosing an appropriate rate in what concerns educational videos for preschool children is fundamental to ensure the comprehension and the cognitive processing of the educational content since their comprehension skills are lower than older children and the rehearsal of the auditory information in the working memory is still developing, as previously mentioned in this work.

Intelligibility

Intelligibility is crucial for preschool children to learn from educational videos since their working memory capacity is lower than in older children, as well as their experience with audiovisual media.

Intelligibility encompasses both auditory and visual information. In what concerns auditory information, when it is distorted or too low, or there is noise behind the narration voices, the learning experience can be undermined due to the need for extraneous processing, i.e., the need to make an additional effort to make sense of

unintelligible or unrelated information given. Similarly, in what regards visual information, when the video or the text within it is too small, and when close shots are used instead of wide shots, the learner is forced to rely on the working memory to integrate the zoomed parts of the video into the whole. Besides increasing the cognitive load, this can result in a lack of comprehension of the educational content, depending on the age or cognitive development of the viewer (Lange & Costley, 2020).

Bearing this in mind, some aspects can influence the intelligibility of educational videos, both in what concerns how they are delivered to the viewer and the techniques used in the editing process. These aspects are the screen size of the displaying device and the shot types used in the production of the videos.

Screen size and intelligibility

Studies conducted with adult viewers on the relationship between the effectiveness of educational videos and the displaying screen size have demonstrated that displaying videos on devices with screens of 1,65 inches or less (such as regular mobile phones) results in poorer learning outcomes than when they are displayed in larger screens (see Kim & Kim, 2012).

This is because the level of small detail humans can see is limited by their visual perception and attention span. Thus, the smaller the screen size, the fewer details learners can see and the shorter the attention they pay to it. On the other hand, when the image or the screen is too large or the visual elements within it are too far from one another, more attention and cognitive effort are necessary to process the whole visual material and the educational content, which can lead to a higher cognitive load (Mayer & Fiorella, 2014; Reeves et al., 1999).

Editing techniques and intelligibility

The literature suggests that some editing techniques that are widely used for older learners can reduce the intelligibility of videos for younger children and

jeopardize their learning experience. For instance, studies using eye-tracking methodology have demonstrated that cuts, commonly used as a tool for retaining and reorienting the attention of the viewers, are unsuitable for younger audiences. As these studies claim, 4-year-old children, for example, are slower than older viewers in making the transition between different shots after a cut and tend to focus on the center of the screen instead of focusing on a relevant character or object, which may cause the loss of information and the disruption of the learning experience (Flynn, Wong, Neuman & Kaefer, 2019; Kirkorian & Anderson, 2017).

Similarly, the understanding of panning shots (pans) is dependent on the capacity of the visuospatial working memory of the viewer (VWM), since it requires that he/she retains most elements of the visual information in the working memory to make sense of the whole scenario. Even though pans are the most straightforward technical element after zoom-in and zoom-out in editing without cuts, using pans in educational videos targeted at young children can undermine their learning experience, since they have a very limited working memory capacity. As some studies have demonstrated, the VWM determines the perception speed and processing, and its capacity increases with age. This means that before four years old most children cannot understand pans because their VWM capacity is under two items, which is the minimum level required for understanding this production technique (Pittorf, Lehmann & Huckauf, 2014).

In addition, the literature suggests that having media sign literacy is fundamental for young children to learn from media by reducing the cognitive load that extraneous processing may cause. Media sign literacy (MSL) is the ability to read media symbols, recognize the patterns they create, and ascribe meaning to them. MSL comprises not only visual symbols but also the formal features and editing techniques of videos, such as sound effects and visual montage. Also, it develops along with the cognitive development of the children, as some specific cognitive skills are necessary to understand some media features. This means that not all children are cognitively ready at the same time to comprehend the meaning of media symbols: for instance, the understanding of zoom shots requires the understanding of physical conservation, which does not usually occur before the concrete operational stage – 7 years old, while

the understanding of panning shots is a demanding task for the working memory in young children (Diergarten, Möckel, Nieding & Ohler, 2017).

There are at least three perceptual skills that are required to understand videos, namely (1) size constancy, (2) perceptual completion, and (3) mental rotation. Regarding size constancy, it refers to the ability to perceive stability in the size of an object, despite the different perceptions of it (caused by the variation in the distance to the observer). The viewer must have the notion of the camera and know that it can move further or closer to an object to perceive the size of that object constantly and to know that it remains the same, regardless of the position of the camera. Regarding perceptual completion, it refers to the ability to see an image as complete when part of it is occluded within the visual field. This ability is required to make sense of closeups or medium shots since they occlude part of the object that is being filmed, and the viewer must understand that it is still present in the scene. In what concerns mental rotation, it refers to the ability to mentally form and rotate an image in space into a different orientation, and it is required to make sense of different camera angles when edited together (Kirbas & Smith, 2019).

Size constancy, perceptual completion, and mental rotation are cognitive and perceptual skills that develop throughout infancy and childhood. Thus, younger children may not be ready to make sense of some video features due to a lack of acquisition or maturation of such abilities. In addition, since studies have demonstrated that adult viewers with no prior exposure to moving images still experience some difficulties in making sense of different shot sizes, for instance, despite having the abovementioned abilities already matured, the exposure to audiovisual objects is paramount for the acquisition of media literacy (Kirbas & Smith, 2019).

Furthermore, the perception of continuity across cuts is also fundamental for understanding videos. Conversely to the beginning of cinema, when narratives were filmed using a single shot with a static camera, contemporary producers use multiple camera perspectives and combine multiple shots by using several editing techniques to achieve more compelling audiovisual objects for the viewers. These techniques follow several rules that have been discussed systematically within the audiovisual industry.

While the Formal Editing Principle (the Hollywood concept of editing) recommends minimizing perceptually disruptive transitions, the modern viewpoint follows the Narrative Editing Principle, i.e., the principle that states that the consistency of the story overrules the perceptually disturbing effects in transitions between shots. Furthermore, the Narrative Editing Principle stresses the importance of deliberately inserting editing violations to highlight critical parts of the story (e.g., reverse-angle shots that violate the 180-degree rule; flashbacks, and ellipsis, that violate the rule of narrative continuity, among others) (Germeys & d'Ydewalle, 2007).

The number and variety of editing techniques have increased throughout the history of audiovisual production. Their influence on the perception of continuity by younger viewers has been studied, focusing on its effect on the comprehension of videos (Kirbas & Smith, 2019).

Four-year-old children, for instance, tend to fixate the center of the screen between shot transitions even if these follow the Formal Editing Principle (without violations), suggesting that young children are not able to anticipate actions when these are presented in edited images (Kirkorian & Anderson, 2017).

Nonetheless, studies have demonstrated that by three years old, most children can already understand simple edited audiovisual narratives (such as cut-ins or cut-outs – the type of cuts after a zoom-in or a zoom-out) because they possess rudimentary media literacy skills that enable them to comprehend such techniques. This suggests that different formal features require different cognitive and perceptual skills to be comprehended (Pittorf, Lehmann & Huckauf, 2014).

In what concerns the cognitive effort required for processing discontinuity in videos, research has demonstrated that the editing rules can be grouped into three levels of difficulty, summarized in table 5.

TABLE 5				
Category	Aims	Type	Description	Violation examples
First-order editing rules	To achieve a smooth perception of apparent movement	Matching the movement	Image combination that preserves the continuity of the movement of a character or of an object when the setting size or the camera axes change (e.g., cut ins and cut outs)	Jump cuts (small displacements of the camera)
		Constant screen direction rule	Image combination that depicts the motion of a character or of an object with a constant motion vector (e.g., shot 1 – exits to right, shot 2 – enters from left)	Reverse-angle shots
Second-order editing rules	To provide the establishment of a spatial-cognitive schema for a scene. For achieving this, the cameras may not cross the center line between two actors	Matched-look rule	Image combination that depicts opposite viewing directions when two characters are dialoguing and only one of them is visible in the image	
Third-order editing rules	To preserve and reinforce the narrative continuity of a story	Chronological continuity		Crosscuttings (image combination between shots that depict alternately parts of events that are occurring simultaneously)
				Flashbacks (image combination between shots that depict past and present events of the narrative)
				Ellipsis (image combination between shots that depict future and present events of the narrative)

Table 5 – Examples of first, second, and third-order editing rules and corresponding violations (source: adapted from Munk, Diergarten, Nieding, Ohler & Schneider, 2012; Munk, Rey, Diergarten, Nieding, Schneider & Ohler, 2012; and Germeys & d'Ydewalle, 2007)

Many preschool children can already understand most of the editing techniques that follow the first-order editing rules (since many of them match visual experiences in their everyday life) (Pittorf, Lehmann & Huckauf, 2014). Nonetheless, regarding the comprehension of techniques that follow the second- and third-order editing rules and their violations, it is achieved only between 6 and 8 years old, which suggests that there is a progression in the understanding of editing techniques that follow the first, second, and third-order rules, occurring in general between 4 and 8 years old (Munk, Rey, Diergarten, Nieding, Schneider & Ohler, 2012).

This is because second- and third-order editing rules and their violations are much harder to process cognitively, since they require the integration of different chronological events into a sequence or the comprehension of compressed time and space (as in crosscuttings, flashbacks, and ellipsis). This is evident even in 8-year-old children (Pittorf, Lehmann & Huckauf, 2014). To aid the comprehension of such elements, many producers use formal features such as blurring the edges of flashback scenes, sometimes changing its coloration into a sepia tone or monochrome, for instance, which promotes the learning of this cinematic symbol (Kirbas & Smith, 2019).

Taking these findings altogether, the literature suggests that to make sense of any audiovisual medium, children must have the perceptual abilities needed to see and hear the content and develop some cognitive and perceptual skills to organize, interpret, and understand it. Furthermore, they must learn to decode cinematic techniques that do not exist in the real (or physical) world (Kirbas & Smith, 2019).

Therefore, to understand videos and what they represent, children must acquire media literacy skills, which can be achieved by experiencing media, i.e., by watching audiovisual products. This means that educational videos can convey educational content and be a powerful tool in helping to ascribe meaning to media symbols such as formal features, thus paving the way for learning from similar objects (Crawley et al., 2002). In other words, educational videos can teach the content they present and how to make sense of other videos.

Quality, media diversity, and congruence

Regarding the quality of the video and of the audio, the literature suggests that when it is poor or the video is outdated, there can be a reduction in the engagement, concentration, interest, and attention of the learners. Similarly, educational videos should encompass media diversity, i.e., combined visual and auditory information, to enhance the learning experience (Mayer, 2014b).

Nonetheless, it is fundamental that these different sources are linked and synchronized (thus being congruent) so that the learner does not get distracted or have to cognitively process extraneous information, increasing the cognitive load in the working memory (Lange & Costley, 2020).

This latter aspect is especially relevant in what concerns educational videos for preschool children since the cognitive processing of educational content from videos is especially challenging for them and their working memory is still extremely limited, as explained previously in this work. Bearing the importance of congruence in mind, translation practices such as dubbing should be taken with caution regarding this type of audience.

Dubbed vs. original versions in learning from videos

Many audiovisual products targeted at preschool children are imported from external markets and dubbed into the native language of the local viewers. Dubbing is the preferred form of audiovisual translation in several countries, such as Spain, France, Germany, and Italy, and even in the countries where subtitling prevails (which is the case of Portugal), audiovisual products aimed at children are usually dubbed (Romero-Fresco, 2020).

Regarding animation programs, animated characters can easily traverse cultural boundaries due to the possibility of dubbing their original language into the language spoken in the markets to which the programs are exported. The same often happens with live-action characters, although they are more difficult to dub than animated

characters due to cultural specificities and increased difficulties in syncing their lips with the dubbing voices (Calvert, 2017).

There are three main areas in which synchrony is paramount in dubbing, namely lip-synchrony (related to vowels and labials), kinetic synchrony (related to the synchrony between gestures and actions and linguistic signs); and isochrony (related to the duration between the utterances in the source and the target texts). Notwithstanding the importance of achieving congruence in these three domains, it is not uncommon to find dubbed cartoons and other products for children with poor synchronization, especially in shots other than closeups, and if they are not created with large displaying screen sizes in mind (Lozano, 2017).

Dubbing is an advantageous translation method because it is easy to adapt the original content to the target language, it facilitates an easy viewing even when the viewer is engaged in other activities, it fosters the feeling of familiarity with the content because the viewer hears his/her language, and it stimulates the acquisition of vocabulary in the native language of the viewer. Nonetheless, this method presents some negative aspects: the need to stretch translations in order to adjust the duration of the speech, the fact that it is easy to manipulate and censor the content since the viewer does not hear the original voices, the poorness of some translations given the need to achieve lip-synchronicity, and the feeling of unnaturalness to the viewer due to the asynchronicity between audio and video (Koolstra, Peeters & Spinhof, 2002).

As audiovisual products for children are dubbed in most countries, children are used to this translation practice from a very young age, which allows them, not only in childhood but throughout their lives, to overlook the lack of complete synchrony between audio and video and suspend disbelief in order to immerse in the fiction (Romero-Fresco, 2020). The suspension of disbelief is the ability that allows the viewer to ignore the limitations of a medium (e.g., the artifice of dubbing) in order to feel engaged while watching a movie, playing a videogame, or reading a book (Chaume, 2013).

Nonetheless, although exposure to dubbing from childhood facilitates the habituation to it, the literature suggests that there is a tolerance threshold in what

regards the level of synchrony and the naturalness of the dialogues. Although this threshold varies across countries, some quality standards should not be disregarded, such as the coherence between what is seen and what is heard, the writing of realistic and credible dialogues, which should be accurate with the source text, should have quality recording and be appropriately performed and dramatized (Romero-Fresco, 2020).

An intriguing aspect of the ability of suspending disbelief while watching a dubbed audiovisual product is that it contravenes the so-called McGurk effect, i.e., an auditory illusion that changes the perception of a phoneme when the articulation of a concurrent phoneme is displayed (Smith, Duede, Hanrahan, Davis, House & Greger, 2013).

In other words, the information from the visual cortex instructs the auditory cortex on what to hear, which causes people to hear the phonemes they watch instead of what they hear. Thus, when there is a mismatch between audio and video, the attention of the viewer is directed to the asynchronous lip movements, and the information becomes very difficult to process, widely affecting its comprehension. Nevertheless, even though the McGurk effect is very robust and evident across cultures, some studies have demonstrated that when watching dubbed audiovisual products, viewers unconsciously perform an eye movement strategy to avoid looking at mouths so that they can be immersed in the fiction. This effect, often named in the literature as the “dubbing effect,” is turned off when watching audiovisual objects in their original versions and in everyday life (Romero-Fresco, 2020).

Moreover, studies have demonstrated that the threshold for the McGurk effect decreases with age, which means that older viewers are more influenced by the vision for understanding auditory information than young children (Hirst, Stacey, Cragg, Stacey & Allen, 2018). Nevertheless, it remains unclear in the literature if dubbing can undermine learning from educational videos.

2.4. THE DISTRIBUTION

This fourth area is dedicated to investigating the challenges of distributing educational videos on digital platforms and how to address them from the perspective of a producer. This area is divided into two topics:

- How algorithms challenge the discoverability of audiovisual products
- Communities of viewers and transmedia strategies as responses to the challenge of discoverability.

Studies have demonstrated that television was the prevailing medium in many countries until very recently (Ponte, Simões, Batista, Castro & Jorge, 2017). Nevertheless, reports concerning media use by children in the United States concluded that by the beginning of 2020, watching online videos on platforms such as YouTube constituted already the largest proportion of audiovisual consumption (Rideout & Robb, 2020). Similarly, in the United Kingdom, the time spent playing and socializing online has surpassed the time spent watching television programs (Basílio, 2018).

Regarding the Portuguese context, recent studies have demonstrated that digital media are present in most Portuguese homes, among smartphones, laptops, and tablets, all connected to the Internet (Ponte, Simões, Batista, Castro & Jorge, 2017). Regarding the use of such devices, children use them from an early age, being the tablet their preferred device and their favorite digital activities are playing games and watching videos on YouTube. Even though parents prefer that their children use digital devices for educational purposes, entertainment is the prevailing motivation for young users (Dias & Brito, 2018).

All the findings above suggest that the dynamics in how children consume audiovisual products are changing radically worldwide. It is not the content that children watch that is changing; instead, it is both the traditional platforms and devices that are being replaced by digital ones (Potter & Steemers, 2020).

Along with this paradigm shift emerges the issue of curatorship of the audiovisual content that children watch because while on television the content is

human-curated, on digital platforms the curation process is made whether by humans or algorithms (depending on the platform). The recommendation is made only by algorithms that select what appears to be most interesting to the viewers. For recommending content, the algorithms start from a probabilistic analysis, combining variables such as the activity data of the user in the platform, video metadata, and the metrics of related videos (McKelvey & Hunt, 2019).

As these data are very different between users, both the recommendation of videos and the presented results of a search vary significantly. This means that the whole distribution model changes between traditional and digital platforms, posing two main challenges for creators and producers: how to make their content discoverable (enhancing discoverability) and how to attract and retain the interest of the viewers in their products (achieving a community of viewers).

How algorithms challenge the discoverability of audiovisual products

Discoverability is related to how digital platforms coordinate software, content, and users to present products to the latter. It affects the consumption of every type of content available on the Internet (e.g., music, games, mobile applications, or videos, among others) (McKelvey & Hunt, 2019). This means that it impacts several structures in the industry, from how users consume audiovisual products (since the access to content influences their viewing experience) to the regulation of the provision of these products (Mazzoli, 2020).

In what concerns videos, digital streaming platforms provide users with a dynamic and personalized architecture of choice. Even though different platforms are built from different architectures and have different interface designs, in most of them, two factors can be identified that determine the discoverability of the content and define the user experience. These factors are surrounds and vectors: surrounds are how platforms arrange choices on screens or between them (i.e., how they display the available content), and vectors are the interactive pathways, guided by software, that the users can take through the content, often displayed as widgets (McKelvey & Hunt, 2019).

On YouTube, some vectors highlight trending or popular content, while others make personalized recommendations to the users (McKelvey & Hunt, 2019). As some studies have demonstrated, while trending or popular video highlight contributes to increasing the ranking of videos that are already high positioned, the YouTube recommendation system contributes to the diversity in video viewing since it increases the visibility of content in which users are interested (Zhou, Khemmarat, Gao, Wan & Zhang, 2016).

Besides the recommendation vectors, YouTube provides a search feature to the users that allows them to enter keywords that describe the content they are looking for (Rieder, Matamoros-Fernández & Coromina, 2018).

In what regards to the algorithms that guide the recommendation vectors, the literature suggests that they usually start from probabilistic analyses combining: user activity data (e.g., history of video viewing and video rating, among others), video metadata (e.g., title, description, views, likes, watch time, recency, and the number of channel subscribers, among others), and the metrics of related videos (McKelvey & Hunt, 2019).

In contrast, regarding the algorithms that guide the search feature, there are few direct links between the search results and video metrics such as view, like, or comment counts, which means that the YouTube algorithms prioritize other factors over these (Rieder, Matamoros-Fernández & Coromina, 2018).

Nevertheless, these factors are difficult to identify since most companies that own digital platforms do not allow direct analysis of their data or technical infrastructures to protect their business models and prevent users from taking advantage of the systems. Therefore, digital media researchers who investigate the behavior of algorithms often use methodologies such as ethnography, data scraping, and reverse engineering (Rieder, Matamoros-Fernández & Coromina, 2018).

The use of such Digital Methods (see Rogers, 2013) aims to analyze the trace of the users who produce and consume content on the Internet, contributing to the understanding of social-cultural phenomena and online behaviors (Ribes, 2020).

Studies in this field have demonstrated that besides the fact that YouTube uses deep-learning neural networks, i.e., software that retunes the outputs of the system depending on the data inserted into it, the algorithms of the platform have been systematically updated since its beginning in 2005. These updates have changed the priority between the variables influencing ranking and video recommendation to lead the users to the videos they want to watch. Initially, the content was highlighted based on the number of clicks or responses in video format. Since 2012, other variables have been prioritized, such as the duration of the video (in which the minimum length was set to 1 minute). This has influenced not only the user experience in the platform but also the creation and production process since creators and producers have had to adapt their content to make it discoverable (Ribes, 2020).

Besides the length of the videos, other factors such as the number of channel subscriptions strongly influence the position of the videos in the search rankings, aiming to encourage the creators to build their audiences and address them (Rieder, Matamoros-Fernández & Coromina, 2018).

When the videos are related to others already well-positioned, their ranking increases, influenced by the rating of recommendations. Within the scope of the relationship between search rankings and recommendations, the literature suggests that they both contribute to the video views in the long term, stabilizing at constant rates when the videos become older (Zhou, Khemmarat, Gao, Wan & Zhang, 2016).

This means that even though recency is another factor that influences rankings in the short term, newly published videos tend to quickly disappear from the top results after a short period if they are not supported by popular referrer videos or other features (Rieder, Matamoros-Fernández & Coromina, 2018).

Finally, one of the most important factors for the position of videos both on search rankings and recommendations is “watch time,” which refers to a combination of several variables, encompassing views, view duration, session start, upload frequency, session duration, and session end. Even though the YouTube algorithms recommend longer videos to users that spend more time on the platform, videos with a length between 10 and 13 minutes are better rated by the system in general. In

addition, it is important to publish regularly since the habit of systematically uploading content positively influences the recommendations of the platform (Ribes, 2020).

Several creators and producers use video optimization practices to enhance the video metadata and the discoverability of their videos from the beginning. This strategy is important given the difficulties in understanding how the YouTube algorithms behave and their updates. Such strategy is particularly relevant in what concerns content targeted at children since some features such as auto-play, comments, personalized advertising, and live chat are turned off, meaning that several other variables that are involved in the ranking mechanisms on videos targeted at older audiences have different weights when displaying this type of products (Balanzategui, 2020).

Research on video optimization practices has presented evidence that the information creators provide about the videos when uploading them can enhance their discoverability in terms of title, description, and tags. Nonetheless, this type of metadata should be chosen with caution, since aspects such as a great availability of information in the title, for instance, are negatively associated with video views. Conversely, a high availability of information in the description is positively associated with video views. Furthermore, even though YouTube does not set a limit for the number of tags, studies have demonstrated that using up to 17 tags can increase the number of views. Beyond this number, the views are negatively affected (Tafesse, 2020).

Communities of viewers and transmedia strategies as responses to the challenge of discoverability

Bearing in mind all the challenges that the YouTube systems represent for discoverability, it is important for creators and producers to build a community of viewers and to be able to maintain their interest in audiovisual products.

As the literature suggests, followers, fans, and friends contribute to disseminating media objects by reposting content and interacting with it, increasing its

visibility and spreading (McKelvey & Hunt, 2019). Furthermore, the recommendation of content by friends in social media networks often prevails over the recommendation of algorithms on media platforms (Nikolic, 2017).

To achieve a solid community of viewers, it is paramount, to begin with, to make them feel engaged, and this engagement can be achieved by adopting a transmedia strategy. Studies have demonstrated that transmedia users feel more involved in the story when compared with users that use a single medium, which results in higher motivation and enjoyment (Dena, 2009; Pietschmann, Völkel & Ohler, 2014). In addition, the literature suggests that a product has a higher probability of reaching a broader audience and becoming more spreadable when it is delivered on multiple platforms (Jenkins, 2013).

When designing a transmedia strategy, it is important to analyze the approach suitable for the audiovisual project and the appropriate platforms to distribute the content. In what concerns the types of transmedia projects, the literature presents three main types or genres: (1) brand extension, (2) stepping stone, and (3) organic transmedia (Bernardo, 2014).

The first genre, brand extension, encompasses the production of complementary content to promote a core product. While the core product is distributed in a single channel or platform (e.g., a TV series), the complementary content is distributed on other platforms for marketing purposes (e.g., alternate endings distributed on social media). The second genre, the stepping stone, entails producing a core product for a digital platform that will later be expanded to other platforms (e.g., a digital game that can become a movie in the future). Finally, the third genre, organic transmedia, refers to the type of project designed to develop a story world on multiple platforms without having a core product (Bernardo, 2014).

Regarding transmedia projects for young children, it is important to acknowledge that not all types are suitable for this target audience. The literature suggests that as younger children are not yet able to comprehend complex content as adults do, it is paramount for producers to consider their information-processing capabilities, attention span, and memory capacities. For instance, preschool children

can already comprehend a continuous narrative, but they are not able to integrate different perspectives and combine subplots (Pietschman, Völkel & Ohler, 2014). For this reason, the organic transmedia genre (Bernardo, 2014) is not suitable for younger children, and the other two genres should be designed considering the specificities of this target audience. The literature suggests that the use of strategies such as repeating colors, forms, perspectives, narratives, and music can be fundamental for familiarizing the children with the content, and for facilitating the recognition of the characters (Pietschman, Völkel & Ohler, 2014).

Regarding the choice of platforms, the literature does not recommend focusing on the trends or the latest releases: producers should investigate how people adapt to technology (Bernardo, 2011). Furthermore, when selecting what platforms to use, creators and producers should consider the objectives of the project, the story, the available budget, time, and resources, and the expectations of the target audience (Nikolic, 2017). In addition, some platforms require the users to be at least thirteen years old, and this legal restriction may limit the suitable channels for a transmedia project (Pietschman, Völkel & Ohler, 2014). Given the variability of these factors, gathering the most information possible through research is crucial for the success of a transmedia project.

To successfully distribute a media product targeted at young children, it is crucial to understand not only how they engage with content on digital platforms but also the dynamics in which they use these platforms, along with their families and other caregivers, in order to achieve a solid community of viewers that can enhance the discoverability of content aimed at them (Balanategui, 2020). This is because even though the target audience of this type of audiovisual product is children, regarding the use of digital platforms, the target audience is the adults that supervise them. Thus, it is fundamental to understand the habits and preferences of these users to meet them in the digital universe.

CHAPTER 3 – RESEARCH DESIGN

This chapter presents the studies we conducted to address the research questions that were not answered in the literature review. We conducted four studies with Portuguese preschool children (Studies 1 to 4) and one study with their families (Study 5), and we present here the results.

Study 1 (section 3.1) aimed to investigate if the efficiency of educational videos for preschool children depends on the use of cognitive and pedagogical strategies in their production and if these strategies have equal importance for learning. This study addressed the following research question: (RQ1.1) *Is learning from educational videos dependent on the use of cognitive and pedagogical strategies in their production?*

We conducted Study 2 (section 3.2) to investigate if the screen size of the device used for consuming educational videos influences the learning outcomes and the engagement of preschool children with the videos. This study addressed the following research question: (RQ3.1) *Do engagement and the learning outcomes from educational videos vary according to the screen size of the displaying devices?*

Study 3 (section 3.3) aimed to investigate if the efficiency of educational videos is affected by the use of continuity editing, i.e., the use of cuts (a first-order editing technique) and the combination of different shot sizes (full shots, medium shots, closeups, and medium closeups). This study addressed the following research question: (RQ3.2) *Is the effectiveness of educational videos affected by using continuity editing?*

We separated Study 3 into two: in Study 3.1, we analyzed the editing of educational videos from *Sesame Street* and *Blue's Clues & You* to understand the good practices in video editing for preschool children. Starting from this analysis, we prepared the video stimulus to be used in Study 3.2. In Study 3.2, we investigated the impact of first-order editing techniques and different shot types on learning from educational videos.

Study 4 (section 3.4) had the objective of investigating if dubbing affects the learning outcomes from educational videos in preschool children, compared to a video

in its original audio version. It addressed this research question: (RQ3.3) *Are dubbed educational videos as effective as not dubbed educational videos?*

Finally, we conducted Study 5 to investigate the dynamics and preferences of consumption of educational videos and related transmedia content by Portuguese families. This study addressed the following research question: (RQ5) *What are the dynamics of Portuguese families in consuming educational videos and related transmedia content?*

We recruited the participants for Studies 1 to 4 through kindergartens near Lisbon and Torres Vedras, with the cooperation of Colégio do Sagrado Coração de Maria, in Lisbon, and the educational service department of Fábrica das Histórias – Municipality of Torres Vedras. We offered a CD of our music project *Lara no País da Música* [*Lara in Musicland*] to children that participated in the study and to their colleagues as well. The parents/caregivers of the participants were informed about the details of the research and provided the informed consents for the participation of their children in the study.

For selecting the participants for these studies, we applied the criteria described in Table 6.

TABLE 6		
Participants	Include	Exclude
Portuguese preschool children	Age: 3-5 years old	Age: <3 years old; >5 years old
	Gender: Female, Male, Non-binary	
	Mother tongue: Portuguese	Mother tongue: Other than Portuguese
	Condition: Able to provide informed consent through parents/caregivers	Condition 1: Cognitive disability; language or hearing impairments that impede understanding audiovisual products. Condition 2: Unable to provide informed consent through parents/caregivers

Table 6 – Inclusion/exclusion table for the participation in studies 1-4 (source: the author)

As this work focused on educational videos for preschool children, we only recruited children between 3 and 5 years old. Given that we had to exclude other variables that could influence the results for investigating the learning outcomes from the videos (e.g., not being able to understand the speech fully) and the video stimuli were in Portuguese, we only included children with Portuguese as a mother tongue.

We began with a general sample of 186 children: 54 children of 3 years old (30 girls and 24 boys); 55 children of 4 years old (23 girls and 32 boys); and 77 children of 5 years old (38 girls and 39 boys).

We distributed the children between studies 1 to 4. We applied a first level of sample selection through quotas to ensure that we had a similar number of children of each age group (3, 4, and 5 years old) in each study.

Even though the number of 5-year-old children slightly surpassed the other age groups in the initial samples of the studies, we decided not to exclude the surpluses because all the participants were preschool children, regardless of the age group.

We distributed the children between the studies considering the necessary number of groups for each study and we set the minimum threshold of 30 participants for each group (intervention and control). We varied the participation of the children between intervention and control groups throughout the studies.

All the children participated in at least 3 of the 4 studies, which means that each study had at least 90 children initially, depending on the number of the intervention groups and control.

The initial samples of the studies had the following composition: 186 children in Study 1, 149 in Study 2, 112 children in Study 3, and 150 children in Study 4 (table 7).

TABLE 7					
Age	Gender	Study 1	Study 2	Study 3	Study 4
3	Overall	54	44	31	44
	F	30	25	20	25
	M	24	19	11	19

4	Overall	55	45	33	44
	F	23	19	12	18
	M	32	26	21	26
5	Overall	77	60	48	62
	F	38	30	26	29
	M	39	30	22	33
Total		186	149	112	150

Table 7 – Initial samples of studies 1-4 (source: the author)

Over the initial samples of each study, we conducted two pre-tests: one on language comprehension skills and another on previous knowledge of the name of musical instruments. As our studies entailed the assessment of learning the name of musical instruments through educational videos, we applied this last pre-test to ensure that the participants did not know the answers before the test.

Regarding the language skills pre-test, we conducted it to exclude the participants that showed a significant difference in the understanding of the Portuguese language within the age groups, given that this difference could affect the results.

For this purpose, we used a short version of the Verbal Definition Test and the Nomination Test from the battery *ALO – Avaliação da Linguagem Oral* [Oral Language Evaluation] (Sim-Sim, 1997), which was originally built for Portuguese native speakers from 3 years old on and is based on the Portuguese cultural context (Viana, Silva, Ribeiro & Cadime, 2017).

This test is based on the presentation of images to the children, followed by the question: “What is this?” or “What is he/she doing?”, depending on if the image depicts an animal/object or an action. The author of the test provides the following instructions: if the child answers the name of the animal/object or says the specific verb that corresponds to the action, two points are given (e.g., a parrot); if the child says the general category of the animal/object or action, 1 point is given (e.g., a bird). Otherwise, no points are given.

We used a short version of the *ALO* battery due to time constraints and given that our objective was not to fully assess the language skills of the children, which is the purpose of the complete version of the battery. Consequently, we could not apply the same criteria that the author recommends. As such, we defined that the minimum threshold of results for participating in the study would be given by the mean less the standard deviation of the sample ($\mu - \sigma$). The participants that scored less than this value were excluded.

Regarding the pre-test on the previous knowledge of the name of musical instruments, we presented to the children a tray of six images of musical instruments – a maraca, a ukulele, a rain stick, a kazoo, a flute, and a piano – and the children were asked to name all the six instruments. This procedure is common in studies concerning word learning from educational videos targeted at preschool children (e.g., Krcmar & Cingel, 2017). Thus, it was adapted and adjusted considering the aims of our studies. The participants that already knew the name of the instruments were excluded.

Even though some participants were excluded from participating in the studies given the abovementioned criteria, we did this exclusion only in the phase of data analysis, i.e., no children were impeded from participating in the data collection process.

Regarding Study 5, we recruited the participants through the same channels of Studies 1 to 4 (Colégio do Sagrado Coração de Maria and the educational service department of Fábrica das Histórias – Municipality of Torres Vedras). 134 Portuguese families with preschool children participated in this study, corresponding to the families of 134 participants of the previous studies.

3.1. Study 1 – Producing educational videos for preschool children: the importance of using cognitive and pedagogical strategies to enhance learning

According to what was reviewed in the literature, children learn best from educational videos when:

- (1) They are three years old or older (Courage, 2017; Barr, 2010)
- (2) The educational content is presented in a narrative form and embedded on it (Linebarger, Brey, Fenstermacher & Barr, 2017; Linebarger & Piotrowski, 2010)
- (3) The narrative is clear and sequential (Fisch, 2017; Fisch, 2013b)
- (4) The contexts and scenarios are familiar to the children, i.e., the children recognize the scenarios from their everyday life (Kirkorian & Anderson, 2008; Linebarger, Brey, Fenstermacher & Barr, 2017)
- (5) The characters are human or human-like, and are diversified regarding gender and ethnicity, so that the children can relate to at least one of them (Fisch & Truglio, 2001);
- (6) The level of complexity of the language the is used is adequate for the age of the children (Fisch, 2017)
- (7) A curriculum is well defined, and the videos aim to meet its goals (Linebarger, Brey, Fenstermacher & Barr, 2017)
- (8) The characters interact with the viewers, whether by making yes/no questions (such as what/where/who/why), or by inviting them to participate, and giving feedback on the possible answers (Krcmar & Cingel, 2017; Reese, Sparks & Leyva, 2010)
- (9) Other pedagogical strategies are used for enhancing comprehension, such as prefacing and summarizing the educational content, labeling objects (avoiding mismatched labeling), matching verbs with actions, and commenting what is shown on the screen (Linebarger, Brey, Fenstermacher & Barr, 2017).

Since the algorithms that recommend content for children on digital platforms do not consider these aspects when recommending educational content, instead focusing on what is appealing or trending (see Covington, Adams & Sargin, 2016; Wilson, 2019), it is of great importance that the families and kindergarten teachers assess the pedagogical quality of the videos before they are shown to children.

Starting from what we reviewed in the literature, we created a digital instrument named EVAT – Educational Videos Assessment Tool, which can be used for assessing the pedagogical quality of educational videos. The EVAT instrument can be accessed at www.evat.pt (figure 2) and is targeted at families and kindergarten teachers. Here we present the instrument and the study we conducted with Portuguese children to validate it.

EVAT – Educational Videos Assessment Tool

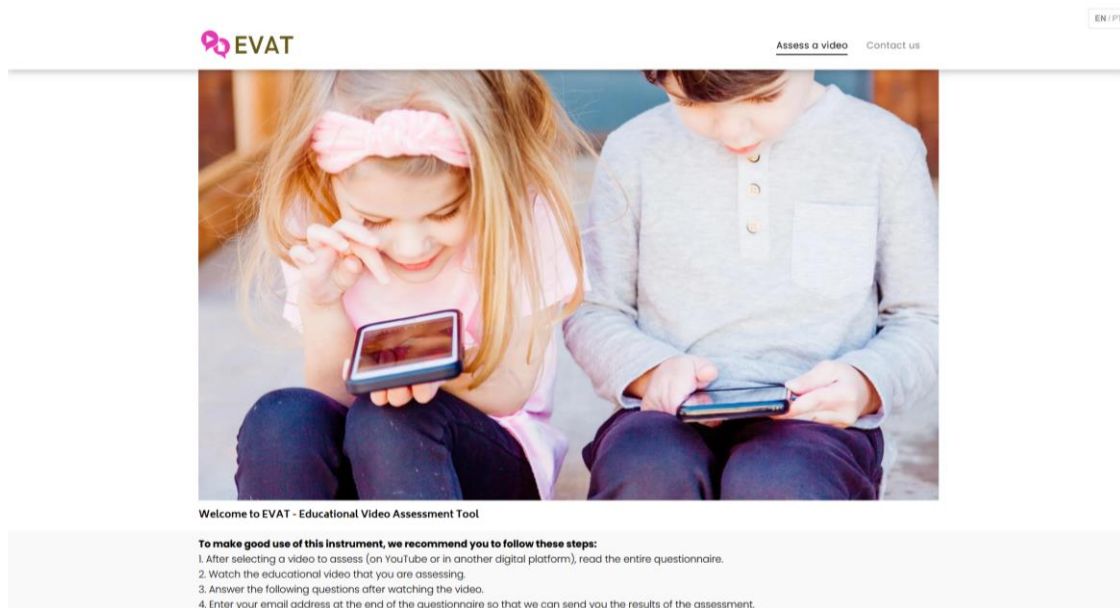


Figure 2 – Screenshot of the website dedicated to the EVAT instrument (www.evat.pt) (source: the author)

The EVAT instrument consists of a questionnaire that surveys critical features of the videos that are easy to identify by adult viewers and intends to provide them with media literacy. The questionnaire is divided into two sections, namely one dedicated

to aspects related to the content (“Content Section”) and another one concerning aspects related to applicability and safety (“Applicability and Safety Section”). The complete list of items is presented in Table 8.

TABLE 8				
		Yes	No	Don't know or N/A
Content Section				
1	Is the episode presented as a story?			
2	If the episode is presented as a story, is it clear and easy to understand?			
3	Are the scenarios similar to the environments in which the child lives?			
4	Is there at least one character (child or adult) that is similar to the child or to whom he/she can relate?			
5	Do you think the dialogues are easy to understand by a preschool child?			
6	Do the characters ask questions directly to the viewers?			
7	Do the characters explain the meaning of novel words/concepts or match them with images after presenting them?			
8	Can you identify what this video was teaching?			
Applicability and Safety Test Section				
1	Is the child three years old or older?			
2	Did you think that the content of this video was polite for preschool children?			
3	Did you feel safe while watching this video?			

Table 8 – EVAT Questionnaire targeted at families and kindergarten teachers (source: the author)

Regarding the “Content Section,” the items were created starting from the guidelines suggested in the literature (previously summarized). Regarding the “Applicability and Safety Section,” the items were created considering three years old as the minimum age for effectively learning from videos and safety as the first and most important requirement for an educational video.

In order to validate the instrument and define the weight of each item, we conducted a study among Portuguese preschool children (3-5 years old) to investigate the importance of using cognitive and pedagogical strategies to enhance learning from educational videos. Here we present the results of this study.

The present study – validation of the EVAT instrument

Considering what the literature suggests, the strategies for creating and producing effective educational videos can be divided into two types: cognitive and pedagogical.

In what regards to cognitive strategies (i.e., strategies that facilitate the cognitive processing of the educational content), the literature suggests that they are present when the videos encompass a sequential narrative, familiar scenarios, human or human-like characters, and simple dialogues. Regarding pedagogical strategies, they are present when the videos have a curriculum-oriented structure, the characters interact with the viewers, and the meaning of new vocabulary is explained or illustrated (please see Table 9).

TABLE 9	
Cognitive strategies	Sequential narrative
	Familiar scenarios
	Human or human-like characters
	Simple dialogues

Pedagogical strategies	Curriculum-oriented structure
	Interaction with the viewers
	Explanation/Illustration of the meaning of new vocabulary

Table 9 – Summary of the cognitive and pedagogical strategies highlighted in the reviewed literature (source: the author)

Starting from table 9, we investigated if the learning outcomes increase with the use of cognitive or pedagogical strategies in the production of educational videos.

We started with the following research question: (RQ1.1) *Is learning from educational videos dependent on the use of cognitive and pedagogical strategies in their production?*

Considering our research question, we hypothesized that:

(H1) the learning outcomes from watching a video that had both cognitive and pedagogical strategies would be higher than from another that had none

(H2) the learning outcomes would not vary between watching videos that had only cognitive or pedagogical strategies

(H3) the learning outcomes from watching a video that had only cognitive or pedagogical strategies would be higher than from another that had none but lower than from other that had both strategies.

Participants

We began with a sample of 186 children. Over this first sample, we conducted two pre-tests: one on language skills and another one on previous knowledge about the name of musical instruments, as explained in the introduction of this chapter. As this study assessed the learning of the name of the kazoo (a musical instrument), the children who already knew it were excluded.

After the first pre-test on language skills, 28 children were excluded from the sample: 8 of 3 years old, 6 of 4 years old, and 14 of 5 years old (table 10).

TABLE 10				
Age	$\bar{X}$	SD	Min. threshold ($\bar{X}$ - SD)	No. excluded
3	6,722222	2,192755	4,529466855	8
4	7,945455	2,189353	5,756101675	6
5	8,753247	2,159166	6,594081197	14

Table 10 – Results of the language skills pre-test of Study 1 (source: the author)

Regarding the pre-test on the name of musical instruments (in this case, the kazoo), eight participants were excluded from participating in the study for already knowing it. Therefore, the final sample was 150 children (80 boys and 70 girls, mean age = 4,12 years old) (table 11).

TABLE 11		
Age	Gender	No. of participants
3	Overall	41
	F	22
	M	19
4	Overall	48
	F	19
	M	29
5	Overall	61
	F	29
	M	32
Total		150

Table 11 – Final sample of Study 1 (source: the author)

Sample characteristics

We asked a set of complementary demographic questions through a questionnaire given to the parents/caregivers regarding the place of residence, household composition, siblings, level of education of the parents/caregivers, and age of the parents/caregivers. Considering the answers given to the questionnaire, our sample has the following characteristics:

(1) It is composed of 150 children between 3 and 5 years old, namely: 41 children of 3 years old (19 boys and 22 girls), 48 children of 4 years old (29 boys and 19 girls), and 61 children of 5 years old (32 boys and 29 girls).

(2) Most children live in the city of Torres Vedras and surroundings (43%).

(3) Most children live in a nuclear family (57%), i.e., with their mother, father, and siblings, if they have one (which is the case of most children – 40%).

(4) Most parents/caregivers who answered the questionnaire completed secondary or vocational education (33%), or hold a bachelor's degree (21%).

(5) Most parents/caregivers who answered the questionnaire are in the age group of 30-39 years old (41,3%).

Table 12 summarizes the sample characteristics.

TABLE 12		
	N	%
Age		
3	41	27,33%
4	48	32,00%
5	61	40,67%
Gender		
Female	70	46,67%
Male	80	53,33%

Place of residence		
Lisbon Metropolitan Area	32	21,33%
Center (Torres Vedras)	65	43,33%
Don't know / No information	53	35,33%
Household composition		
Nuclear family	85	56,67%
Extended or joint family	6	4,00%
Single-parent family	4	2,67%
Reconstituted family	2	1,33%
Don't know / No information	53	35,33%
Siblings		
At least one sibling	60	40,00%
Only child	37	24,67%
Don't know / No information	53	35,33%
Level of education of the parents/caregivers		
Master's degree or Ph.D.	12	8,00%
Bachelor's degree	31	20,67%
Secondary/vocational education	50	33,33%
Primary education	4	2,67%
Don't know / No information	53	35,33%
Age groups of the parents/caregivers		
Less than 30 years old	9	6,00%
30-39 years old	62	41,33%
Above 40 years old	26	17,33%
Don't know / No information	53	35,33%

Table 12 – Sample characteristics of Study 1 (source: the author)

Video Stimuli

Four video segments (V1, V2, V3, and V4) with a mean length of 00:00:40 were previously recorded, applying different cognitive and pedagogical strategies, as described in Table 13.

On V1, we applied cognitive and pedagogical strategies, such as a sequential narrative, familiar scenarios, human or human-like characters, simple dialogues (cognitive strategies), a curriculum-oriented structure, interaction with the viewers, and explanation/illustration of the meaning of new vocabulary (pedagogical strategies). On V2, we applied only pedagogical strategies; on V3, only cognitive strategies; on V4, we did not apply cognitive or pedagogical strategies. The strategies applied in each video are summarized in Table 13.

TABLE 13		V1	V2	V3	V4
Cognitive strategies	Sequential narrative	X		X	
	Familiar scenarios	X		X	
	Human or human-like characters	X		X	
	Simple dialogues	X		X	
Pedagogical strategies	Curriculum-oriented structure	X	X		
	Interaction with the viewers	X	X		
	Explanation/Illustration of the meaning of new vocabulary	X	X		

Table 12 – Cognitive and pedagogical strategies applied in the production of the video segments (source: the author)

When the video structure was curriculum-oriented (on V1 and V2), the objective was to teach what a kazoo (a musical instrument) is. Considering the strategies that were applied, the video segments had the plots presented in table 14 (to read the scripts, please see Appendix 1).

TABLE 14

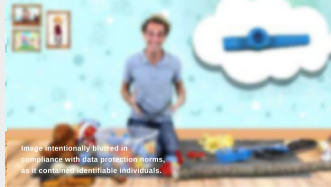
Video segment	Plot and hyperlink	Screenshot
V1	A male character is looking for his kazoo because he can make funny sounds with it. The scenario is at home and the dialogues are easy. The meaning of new vocabulary is explained/illustrated, and the character interacts with the viewers. The curriculum goal is to teach what a kazoo is. Link to the video: https://youtu.be/td2nADW7M-Q	
V2	A person dressed and masked as a bear is holding and interacting with a kazoo while passing by other instruments and interacting with them. The background is entirely white. The meaning of new vocabulary is explained/illustrated, the character interacts with the viewers, and the curriculum goal is to teach what a kazoo is. Link to the video: https://youtu.be/ype82OSK7Do	
V3	A male character is looking for an instrument with which he can make funny sounds. The scenario is at home, and the dialogues are easy. The meaning of new vocabulary is not explained/illustrated, and the character does not interact with the viewers. A kazoo is shown in the middle of the story. Link to the video: https://youtu.be/DAGKC-eEYF4	
V4	Loose vignettes (expository format) show the image of several instruments while a narrator says their names. The image of a kazoo is in one of the vignettes. Link to the video: https://youtu.be/BbnKL93Fy4w	

Table 14 – Plot and screenshots of the video segments (source: the author)

Procedure

The children were randomly assigned to one of five groups (G1, G2, G3, G4, and G5). Groups 1 to 4 corresponded to the displaying of one of the different video segments (V1, V2, V3, and V4), and G5 corresponded to the control group, to which we

displayed a video segment of a cartoon unrelated to music education (link to the video: <https://youtu.be/DDX0XuEMomY>).

To each participant in each group, we played the correspondent video segment on a laptop (13 inches screen and HD resolution) in rooms with identical displaying conditions.

After viewing the video, we presented the image of the kazoo and five other musical instruments: a maraca, a ukulele, a rain stick, a flute, and a piano. After presenting the images and once the child paid attention to them, we asked: “Where is the kazoo?”. The question was repeated until the child pointed at one of the images, or after 1 minute with no answers.

After this procedure, for the children that pointed at the kazoo, we said: “Let’s play one more time!”. Then, we presented the images a second time, in a different order, asking the same question, “Where is the kazoo?”. Once again, the question was repeated until the child chose an image, or after 1 minute with no answers.

This method is appropriate for assessing the learning outcomes in the second level of the Learning Taxonomy of Bloom (“understanding” – please see Chapter 2, section 2.1). It was adapted from studies that investigated the impact of certain features on educational videos for vocabulary learning on young children. Krcmar and Cingel (2017), for instance, studied the effect of direct address on learning from videos in preschool children. O’Doherty, Troseth, Shimpi, Goldenberg, Ahktar, & Saylor (2011), in turn, studied the effect of a third-party social interaction on learning from videos – toddlers). As the present study had a similar objective, i.e., to investigate the learning of the name of a musical instrument through an educational video, and our sample was composed of preschool children, we adapted and used the procedure for this purpose.

Scoring procedure

If the children pointed twice at the kazoo (the right image), 1 point was given. Otherwise, no points were given.

Results

We prepared a database with the collected data for the study using the following fields: age, group, and score. In addition, we added fields from the demographic survey we delivered to the families, namely: age of the parents, consumption frequency of educational videos, siblings, and use frequency of the smartphone, tablet, and computer. We did this to search for correlations between the variables. Then, we erased the missing values, given that some families did not respond to some questions of the survey. Afterward, we started the statistical analysis on SPSS software.

Table 15 presents the hypotheses of the present study with the group conditions.

TABLE 15	
	Hypotheses considering group conditions
H1 LO video with both cognitive and pedagogical strategies > LO video without cognitive nor pedagogical strategies	LO G1 > LO G4
H2 LO video with cognitive strategies = LO video with pedagogical strategies	LO G3 = LO G2
H3 LO video with cognitive strategies and LO video with pedagogical strategies > LO video without cognitive nor pedagogical strategies BUT < video with both cognitive and pedagogical strategies	LO G3 > LO G4 LO G2 > LO G4 LO G2 < LO G1 LO G3 < LO G1

Table 15 – Hypotheses of the study, considering the group conditions (source: the author)

Firstly, we ran a crosstabs analysis with the fields of score and group to get an overall view of the performance of each group (percentage of right and wrong answers). In addition, we ran a chi-square test to verify if the association between the variables is statistically significant. We present the results in Table 16.

TABLE 16

ScoreS1 * Group Crosstabulation								
			Group					
			1	2	3	4	5	Total
ScoreS1	0	Count	1	14	4	10	25	54
		% within Group	3,2%	51,9%	12,9%	29,4%	92,6%	36,0%
	1	Count	30	13	27	24	2	96
		% within Group	96,8%	48,1%	87,1%	70,6%	7,4%	64,0%
Total		Count	31	27	31	34	27	150
		% within Group	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	62,747 ^a	4	<,001
Likelihood Ratio	70,502	4	<,001
Linear-by-Linear Association	28,956	1	<,001
N of Valid Cases	150		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 9,72.

Table 16 – Crosstabulation analysis (score/group) of Study 1 (source: SPSS software)

As previously mentioned, G1 watched the video stimulus with cognitive and pedagogical strategies, G2 the video with pedagogical strategies only, G3 the video with cognitive strategies only, G4 the video without cognitive or pedagogical strategies, and G5 was the control group.

Table 16 shows that the group with the highest percentage of right answers was G1 (96,8%), corresponding to the video stimulus with cognitive and pedagogical strategies. Besides G5, the control group, G2 had the lowest percentage of right answers (48,1%), corresponding to the video stimulus with pedagogical strategies only. G3 obtained a percentage of right answers of 87,1%, corresponding to the video stimulus with cognitive strategies only, and G4 obtained 70,6% of right answers, corresponding to the video stimulus without cognitive or pedagogical strategies.

To compare the success rate (rate of right answers) between groups 1 to 5 and verify the statistical significance of the obtained results, we ran an independent-sample proportions test for all the paired combinations. We chose this statistic test

because we measured the learning outcomes binarily, coding 1 for a right answer and 0 for a wrong answer. We present the summary of the results of this test in Table 17. To see the detailed results, please see Appendix 2.

TABLE 17				
	G1	G2	G3	G4
G2	G1 > G2 P < 0,001	-	-	-
G3	G1 = G3 P > 0,05	G2 < G3 P < 0,001	-	-
G4	G1 > G4 P < 0,005	G2 < G4 P < 0,075	G3 > G4 P < 0,10	-
G5	G1 > G5 P < 0,001	G2 > G5 P < 0,001	G3 > G5 P < 0,001	G4 > G5 P < 0,001

Table 17 – Summary of the results of the independent-sample proportions test (paired between groups)
(source: the author)

As Table 17 shows, G1, G2, G3, and G4 presented a higher success rate than G5. This result was already expected, given that G5 was the control group. In addition, G1 had better performance than G2 and G4, but not than G3, obtaining a similar success rate. G2 had poorer performance than G3 and G4, and G3 had a higher success rate than G4.

To assess if there was any other influence on the results besides the video stimuli, we ran a bivariate correlation analysis between each pair of the available variables and focused on their correlations with the score. We present the results of this test in Table 18.

TABLE 18

		Correlations								
		Age	ScoreS1	Parents age	Watching frequency	Siblings	Smartphone_frequency	Tablet_frequency	Computer_frequency	Parents_education
Age	Pearson Correlation	1	,174*	,026	,021	,083	,135	,136	,033	-,065
	Sig. (2-tailed)		,033	,804	,841	,417	,188	,184	,752	,528
	N	150	150	97	97	97	97	97	97	97
ScoreS1	Pearson Correlation	,174*	1	-,179	-,137	,053	,099	-,005	,096	,009
	Sig. (2-tailed)	,033		,080	,182	,603	,334	,960	,348	,933
	N	150	150	97	97	97	97	97	97	97
Parents age	Pearson Correlation	,026	-,179	1	-,013	,262	-,074	,076	,213	,361
	Sig. (2-tailed)	,804	,080		,899	,009	,471	,459	,037	<,001
	N	97	97	97	97	97	97	97	97	97
Watching frequency	Pearson Correlation	,021	-,137	-,013	1	-,101	,482**	,294**	,086	-,076
	Sig. (2-tailed)	,841	,182	,899		,324	<,001	,003	,401	,462
	N	97	97	97	97	97	97	97	97	97
Siblings	Pearson Correlation	,083	,053	,262**	-,101	1	-,079	,129	,121	,068
	Sig. (2-tailed)	,417	,603	,009	,324		,442	,207	,236	,505
	N	97	97	97	97	97	97	97	97	97
Smartphone_frequency	Pearson Correlation	,135	,099	-,074	,482**	-,079	1	,395**	,039	-,223*
	Sig. (2-tailed)	,188	,334	,471	<,001	,442		<,001	,705	,028
	N	97	97	97	97	97	97	97	97	97
Tablet_frequency	Pearson Correlation	,136	-,005	,076	,294**	,129	,395**	1	,338**	,027
	Sig. (2-tailed)	,184	,960	,459	,003	,207	<,001		<,001	,791
	N	97	97	97	97	97	97	97	97	97
Computer_frequency	Pearson Correlation	,033	,096	,213*	,086	,121	,039	,338**	1	,200*
	Sig. (2-tailed)	,752	,348	,037	,401	,236	,705	<,001		,050
	N	97	97	97	97	97	97	97	97	97
Parents_education	Pearson Correlation	-,065	,009	,361**	-,076	,068	-,223*	,027	,200*	1
	Sig. (2-tailed)	,528	,933	<,001	,462	,505	,028	,791	,050	
	N	97	97	97	97	97	97	97	97	97

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 18 – Results of the bivariate correlations analysis (source: SPSS software)

Table 18 shows a positive correlation between age and overall score. This was already expected since 5-year-old children are more advanced in cognitive development than 3-year-old children and learning from videos requires the maturation of several cognitive structures related to media skills and comprehension. As the literature suggests, three years old is the minimum threshold age for learning from educational videos.

Discussion and preliminary conclusions

The present study aimed to investigate the importance of using cognitive and pedagogical strategies in producing educational videos for preschool children to enhance learning from them. We prepared four video stimuli with different characteristics and assessed their learning outcomes with 150 Portuguese children.

The results of this study suggest that children learn best from educational videos when producers apply cognitive and pedagogical strategies, such as using a sequential narrative, familiar scenarios, human or human-like characters, simple dialogues, a curriculum-oriented structure, interaction with the viewers, and explanation/illustration of new vocabulary, meeting what we had reviewed in the literature. Nonetheless, this study demonstrates that cognitive and pedagogical strategies do not have the same weight in learning from educational videos, conversely to what we hypothesized. Our results suggest that cognitive strategies are more important than pedagogical, regarding the second level of the Learning Taxonomy of Bloom. Table 19 presents the results of the validation of our hypotheses.

TABLE 19			
Hypotheses considering group conditions		Results	Remarks
H1	LO G1 > LO G4	True	
H2	LO G3 = LO G2	False	LO G3 > LO G2
H3	LO G2 > LO G4	Partially true	False → LO G2 < LO G4
	LO G3 > LO G4		True
	LO G2 < LO G1		True
	LO G3 < LO G1		False → LO G3 = LO G1

Table 19 – Results of the hypotheses of Study 1, considering the group conditions (source: the author)

Considering the results of the hypotheses presented in Table 19, H1 was validated, meaning that the video stimulus with both cognitive and pedagogical strategies (V1) resulted in higher learning outcomes than the video stimulus without cognitive or pedagogical strategies (V4).

H2 was not validated since the learning outcomes from the video stimulus with cognitive strategies only (V3) resulted in higher learning outcomes than the video stimulus with pedagogical strategies only (V2).

We considered H3 partially true, given that the video stimulus with pedagogical strategies only (V2) resulted in lower learning outcomes than the video stimulus without cognitive or pedagogical strategies (V4) and that the video stimulus with cognitive strategies only (V3) resulted in similar learning outcomes than the video stimulus with cognitive and pedagogical strategies (V1). As we hypothesized, the video stimulus with cognitive strategies only (V3) resulted in higher learning outcomes than the video stimulus without cognitive or pedagogical strategies (V4), and the video stimulus with pedagogical strategies only (V2) resulted in lower learning outcomes than the video stimulus with cognitive and pedagogical strategies (V1).

Furthermore, as the literature suggests, age influences learning from educational videos, which we demonstrated with a correlation analysis where we identified a positive correlation between age and learning outcomes.

Validation and methodology for the use of the EVAT instrument

As mentioned at the beginning of the present study, we created an instrument for assessing the pedagogical quality of educational videos for preschool children, named EVAT – Educational Videos Assessment Tool. Given that this instrument was created from the literature review, our study aimed to validate it and define the weight of each item.

Considering the results we obtained, the instrument is validated since using cognitive and pedagogical strategies is fundamental for the efficiency of educational videos, and the questionnaire covers the application of such strategies.

In what concerns the section of “Applicability and Safety Test,” if the answers are other than “yes,” the video should not be shown to the children since this test does not apply to children younger than three years old, and the video must be a safe learning environment. We determined these conditions following what we reviewed in the literature and from the premise that the primary concern regarding content targeted at children must be their safety.

In what regards to the “Content Section,” to define the relative weight of the two types of strategies, we compared the success rates of G2 (video stimulus: pedagogical strategies only – 48,1%) and G3 (video stimulus: cognitive strategies only – 87,1%) in the crosstabs analysis. G3 has 1,81 times the success rate of G2. To keep a similar proportion between the two types of strategy, each positive answer to an item referring to a cognitive strategy will account for 1,81 points in the overall score, and each item referring to a pedagogical strategy will account for 1 point. The final score can be of a maximum of 12 points (rounded) (table 20).

If the video scores below 6 points, the result of the assessment will be “inappropriate for learning.” If it scores between 6 and 8 points, the result will be “appropriate for learning.” If the score is above 8 and below 10 points, the result will be “good for learning.” Finally, if the video scores 10 points or higher, the result will be “excellent for learning.”

TABLE 20

		Strategy type	Score
Content Section			
1	Is the episode presented as a story?	Cognitive	1,81
2	If the episode is presented as a story, is it clear and easy to understand?	Cognitive	1,81
3	Are the scenarios similar to the environments in which the child lives?	Cognitive	1,81
4	Is there at least one character (child or adult) that is similar to the child or to whom he/she can relate?	Cognitive	1,81
5	Do you think the dialogues are easy to understand by a preschool child?	Cognitive	1,81
6	Do the characters ask questions directly to the viewers?	Pedagogical	1

7	Do the characters explain the meaning of novel words/concepts or match them with images after presenting them?	Pedagogical	1
8	Can you identify what this video was teaching?	Pedagogical	1
Total scoring			12
Applicability and Safety Test			
1	Is the child three years old or older?	N/A	Appropriate if "yes" (only)
2	Did you think that the content of this video was polite for preschool children?	N/A	Appropriate if "yes" (only)
3	Did you feel safe while watching this video?	N/A	Appropriate if "yes" (only)

Table 20 – Scoring criteria for the EVAT questionnaire (source: the author)

Preliminary conclusions

From the results we obtained in the present study, we concluded that the use of both cognitive and pedagogical strategies in the production of videos have an explicit impact on learning from them. Therefore, producers should include these strategies when producing this type of content.

Furthermore, regarding vocabulary learning at the second level of the Learning Taxonomy of Bloom ("understanding"), cognitive strategies have a significantly higher impact (1,8 times higher) than pedagogical strategies. This may be explained by the fact that for learning a novel word, a curriculum-oriented structured is less important than the conditions in which the word is cognitively processed. Further investigation should focus on the assessment of the relative importance of cognitive vs. pedagogical strategies at more complex tiers of the Learning Taxonomy of Bloom.

Finally, the application of the results of this study lead to the validation of the EVAT tool, which is now available to families and kindergarten teachers. The use of this instrument can be of paramount importance to ensure that preschool children

consume good quality educational content, while providing media literacy to the families.

The EVAT instrument can be accessed at www.evat.pt and is available both in Portuguese and English. For creating the website, we registered the domain with Amen (www.amen.pt), and we built the website using their Simply Site tool. We bought the rights of the image on the homepage on Shutterstock (www.shutterstock.com), and we created the logo using the Looka platform (www.looka.com).

For using the EVAT instrument, the users should select a video to assess, read the entire questionnaire, watch the educational video they are assessing, and then answer the questionnaire. After answering the questionnaire, the users receive an e-mail with the assessment results.

All the data submitted through the EVAT instrument are treated anonymously, ensuring the privacy of the users. The personal data collected through this website are treated only to deliver the results of the evaluation of the video they submitted to the users. Thus, it will not be shared with third parties and will not be used for any purpose that the users do not expressly authorize.

3.2. Study 2 – Digital devices and learning: the influence of the screen size on learning outcomes and engagement of preschool children with educational videos

As previously mentioned in this work, the effectiveness of educational videos is dependent not only on their characteristics but also on the conditions in which they are displayed to the viewers. Learning from videos requires the cognitive processing of both visual and auditory information, and when one or both components are not delivered adequately, the cognitive processing of the content becomes difficult.

Considering what the literature suggests, aspects such as speech pace, intelligibility, quality, media diversity, and congruence are paramount for achieving efficient educational videos (Lange & Costley, 2020). This is especially relevant in what concerns videos targeted at young children since their working memory is still very limited, and many of their cognitive structures are still developing, which poses additional challenges for the comprehension and the cognitive processing of the content (Diergarten, Möckel, Nieding & Ohler, 2017).

Regarding the achievement of intelligibility on the videos, i.e., the quality of being accurately seen and heard by the viewers, the reviewed authors claim that the auditory information cannot be distorted, too low, or have extraneous noise (Lange & Costley, 2020). Similarly, the visual information cannot contain elements that are too small or too distant from others on the screen. Therefore, the videos should be produced considering the abovementioned aspects. In addition, the screen size on which the videos are displayed plays a crucial role in intelligibility; consequently, they should not be too small or too large.

Bearing this in mind, this study aimed to assess the differences in the learning outcomes of educational videos targeted at preschool children when they are displayed on large, medium, and small screens.

In addition, following the claims of some authors regarding how different screen sizes can affect the engagement of users in other types of media for children (Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebadi & Hajar, 2015), we

intended to investigate how engagement in preschool viewers of educational videos varies between the displaying on screens of large, medium, and small dimensions.

Taking into account the methodology used in research on child engagement with e-books and other mobile applications, we consider that engagement with educational videos can be assessed in preschool children by observing several salient behaviors within the categories described in Table 21.

TABLE 21		
Category	Definition	Salient behavior(s)
Multisensory behaviors	Using visual, auditory, and kinesthetic senses	Looking at the screen
		Listening to the audio stream
		Positioning the body to view the screen
		Using bodily actions to communicate, such as gesturing and pointing
Communication	Using verbal and nonverbal behaviors to communicate	Using facial gestures to express thoughts and feelings (positive or negative)
		Using speech to comment or answer questions or making noises to express thoughts or feelings

Table 21 – Categories and salient engagement behaviors in preschool children when watching educational videos (source: the author, adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015)

The present study

Starting from Table 21, we analyzed the salient behaviors of the children to whom we displayed an educational video on three different devices: a laptop (large screen size), a tablet (medium screen size), and a mobile phone (small screen size). Furthermore, as mentioned previously, we assessed the learning outcomes of displaying an educational video on these devices.

We started with the research question: (RQ3.1) *Do engagement and the learning outcomes from educational videos vary according to the screen size of the displaying devices?*

Our hypotheses were the following:

(H1) the learning outcomes would be higher when displaying a video on a medium screen size device (tablet) than when displaying it on a large or a small screen size device (computer and mobile phone);

(H2) there would not be significant differences in the learning outcomes when displaying a video on a large or a small screen size device (computer and mobile phone);

(H3) the engagement would be higher when displaying a video on a medium screen size device (tablet) than when displaying it on a large or a small screen size device (computer and mobile phone);

(H4) there would not be significant differences in engagement when displaying a video on a large or a small screen size device (computer and mobile phone);

(H5) engagement influences the learning outcomes from educational videos, regardless of the screen size on which they are displayed.

Participants

We began with a sample of 149 children. Similarly to the procedure that we adopted in Study 1 of this work, we conducted two pre-tests over the initial sample: one on language skills and another on the previous knowledge of the name of the ukulele, given that this study had the objective to assess the learning of what a ukulele is.

After applying the pre-test on language skills, 20 children were excluded from the initial sample: 6 of 3 years old, 5 of 4 years old, and 9 of 5 years old (table 22).

TABLE 22				
Age	$\bar{X}$	SD	Min. threshold ($\bar{X}$ - SD)	No. excluded
3	6,711111	2,252496	4,458615301	6
4	7,822222	2,198025	5,624197397	5
5	9,033333	2,033338	6,999995369	9

Table 22 – Results of the language skills pre-test of Study 2 (source: the author)

Regarding the pre-test to assess the previous knowledge of the name of the ukulele, five children were excluded for already knowing it. Thus, the final sample was composed of 124 children (64 boys and 60 girls, mean age = 4,13 years old) (table 23).

TABLE 23		
Age	Gender	No. of participants
3	Overall	34
	F	19
	M	15
4	Overall	40
	F	17
	M	23
5	Overall	50
	F	24
	M	26
Total		124

Table 23 – Final sample of Study 2 (source: the author)

Sample characteristics

We handed in a questionnaire to the parents/caregivers, in which we asked a set of complementary demographic questions. These questions regarded the place of residence, the household composition, the existence of siblings, and the level of education and age of the parents/caregivers. Considering the answers we obtained, our sample has the following characteristics:

(1) It is composed of 124 children between 3 and 5 years old, namely: 34 children of 3 years old (15 boys and 19 girls), 40 children of 4 years old (23 boys and 17 girls), and 50 children of 5 years old (26 boys and 24 girls).

(2) Most children live in the city of Torres Vedras and surroundings (40%).

(3) Most children live in a nuclear family (59%) and have siblings (42%).

(4) Most parents/caregivers who answered the questionnaire completed secondary or vocational education (35,5%), or hold a bachelor's degree (20%).

(5) Most parents/caregivers who answered the questionnaire are in the age group of 30-39 years old (46,8%).

Table 24 summarizes the sample characteristics.

TABLE 24		
	N	%
Age		
3	34	27,42%
4	40	32,26%
5	50	40,32%
Gender		
Female	60	48,39%
Male	64	51,61%

Place of residence		
Lisbon Metropolitan Area	23	18,55%
Center (Torres Vedras)	50	40,32%
Don't know / No information	51	41,13%
Household composition		
Nuclear family	73	58,87%
Extended or joint family	5	4,03%
Single-parent family	4	3,23%
Reconstituted family	1	0,81%
Don't know / No information	41	33,06%
Siblings		
At least one sibling	52	41,94%
Only child	31	25,00%
Don't know / No information	41	33,06%
Level of education of the parents/caregivers		
Master's degree or Ph.D.	10	8,06%
Bachelor's degree	25	20,16%
Secondary/vocational education	44	35,48%
Primary education	4	3,23%
Don't know / No information	41	33,06%
Age groups of the parents/caregivers		
Less than 30 years old	7	5,65%
30-39 years old	58	46,77%
Above 40 years old	18	14,52%
Don't know / No information	41	33,06%

Table 24 – Sample characteristics of Study 2 (source: the author)

Video Stimuli

A video segment (V1) with a length of 00:01:07 was previously recorded, applying the following cognitive and pedagogical strategies: a sequential narrative, familiar scenarios, human or human-like characters, simple dialogues, a curriculum-oriented structure, interaction with the viewers, and explanation/illustration of the meaning of new vocabulary, as suggested by the results of Study 1 of this work. The objective of the video was to teach what a ukulele is. The plot of the video segment (V1) is described in Table 25 (for reading the script, please see Appendix 1).

TABLE 25

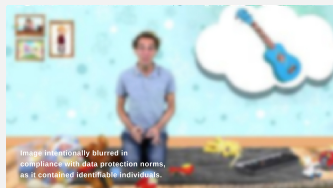
Video segment	Plot and hyperlink	Screenshot
V1	A male character is looking for his ukulele because he wants to play a song with it. The scenario is at home and the dialogues are easy. The meaning of new vocabulary is explained/illustrated, and the character interacts with the viewers. The curriculum goal is to teach what a ukulele is. Link to the video: https://youtu.be/7En0lqhlYgY	

Table 25 – Plot of the video segment (source: the author)

Procedure

The participants were randomly assigned to one of four groups (G1, G2, G3, and G4). To the children in G1, the video segment V1 was displayed on a tablet (10,9 inches screen and HD resolution). To the children in G2, the video segment V1 was displayed on a laptop (13 inches screen and HD resolution). To the children in G3, the video segment V1 was displayed on a mobile phone (6,5 inches screen and HD resolution). G4 corresponded to the control group, to which we displayed a video segment of a cartoon unrelated to music education (link to the video: <https://youtu.be/DDX0XuEMomY>).

After viewing the video, we presented the image of the ukulele and of five other musical instruments: a maraca, a kazoo, a rain stick, a flute, and a piano. After presenting the images and once the child paid attention to them, we asked: “Where is the ukulele?”. The question was repeated until the child pointed at one of the images, or after 1 minute with no answers.

After this procedure, for the children that pointed at the ukulele, we said: “Let’s play one more time!”. Then, we presented the images a second time, in a different order, asking the same question, “Where is the ukulele?”. Once again, the question was repeated until the child chose an object, or after 1 minute with no answers.

This method was the same one we used in Study 1 of this work since both studies intended to assess the learning outcomes from educational videos. The procedure has been adapted from studies that investigated vocabulary learning from educational videos on young children (e.g., Krcmar & Cingel, 2017; O’Doherty, Troseth, Shimpi, Goldenberg, Ahktar, & Saylor, 2011).

In what regards to the assessment of engagement, we registered the salient behaviors of the viewers considering the coding rules described in table 26. This procedure was adapted from the one used in studies which had the objective of assessing the engagement of children with e-books and other mobile applications (Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015). Thus, we adapted it for assessing engagement with educational videos.

TABLE 26

Category	Definition	Salient behavior(s)	Coding rule
Multisensory behaviors	Using visual, auditory, and kinesthetic senses	Looking at the screen	Code LO if eyes are positioned to the screen
		Listening to the audio stream	Code LI if not talking and looking at the screen
		Positioning the body to view the screen	Code PO if moving the body to orient to the screen
		Using bodily actions to communicate	Code GE if using gestures or pointing to communicate

Communication	Using verbal and nonverbal behaviors to communicate	Using facial gestures to express thoughts and feelings (positive or negative)	Code P for smiling, NE for neutral, and N for frowning or other negative facial expressions
		Using speech to comment or answer questions or making other sounds to express thoughts or feelings	Code A for answering questions, C for commenting, and S for other sounds, such as laughter

Table 26 – Coding rules for salient behaviors of engagement when watching the video segment (source: the author, adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015)

Scoring procedure for learning outcomes

If the children pointed twice at the ukulele (the right image), 1 point was given. Otherwise, no points were given.

Scoring procedure for engagement

In what concerns the registration of the salient behaviors to analyze the engagement of the children, we used table 27 to register them, considering the coding rules previously mentioned in table 27. If the behavior was registered, 1 point was given in the “registration of occurrence” row. Otherwise, no points were given.

TABLE 27										
	Multisensory behaviors				Communication					
					Facial gestures			Speech/other sounds		
	LO	LI	PO	GE	P	NE	N	A	C	S
Registration of occurrence										

Table 27 – Registration of the salient engagement behaviors of participants while watching the video segment (source: the author, adapted from adapted from Roskos, Burstein & You, 2012; Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebanti & Hajar, 2015)

After this registration, we summed the points for the salient behaviors that showed engagement and enjoyment while watching the educational video, namely looking, listening, positioning the body, gestures or pointing, smiling, answering questions, commenting, and sounds such as laughter.

For intercoder reliability, two researchers registered the salient behaviors of engagement of the children while watching the educational video on different devices. The percentage of agreement was calculated by summing the total points given by each coder for each participant, then calculating the percentage of correspondence, and finally calculating the average of agreement, which was 90%. The occurrences of disagreement were resolved by mutual agreement of the researchers.

Results

To our initial database, containing the fields of age, group, and score, we added data from the demographic survey we delivered to the families, namely the age of the parents, the consumption frequency of educational video, siblings, and the use frequency of smartphones, tablets, and computers when watching educational videos, to search for correlations between all the available variables. Since some families did not respond to all the questions of the survey, we erased the missing values. We ran the statistical analysis on SPSS software.

Table 28 presents the hypothesis of the present study with the group conditions.

TABLE 28	
	Hypotheses considering group conditions
H1 LO videos on medium screen size device (tablet) > LO videos on large or small screen size devices (computer and mobile phone)	LO G1 > LO G2 LO G1 > LO G3
H2 LO videos on large screen size device (computer) = LO videos on small screen size device (mobile phone)	LO G2 = LO G3

H3	Engagement with videos on medium screen size device (tablet) > Engagement with videos on large or small screen size device (computer and mobile phone)	ENG G1 > ENG G2 ENG G1 > ENG G3
H4	Engagement with videos on large screen size device (computer) = Engagement with videos on small screen size device (mobile phone)	ENG G2 = ENG G3
H5	Engagement influences the learning outcomes from educational videos	

Table 28 – Hypotheses of the study, considering the group conditions (source: the author)

Firstly, to compare the learning outcomes between the groups, we ran a crosstabs analysis with the fields of score and group to obtain an overall view of how each group performed in identifying the musical instrument after watching the video. We analyzed the performance of the groups from the percentage of right and wrong answers. In addition, we ran a chi-square test to verify if the association between the variables is statistically significant (table 29).

TABLE 29

Score S2 * Group Crosstabulation

		Group				Total	
		1	2	3	4		
Score S2	0	Count	6	5	4	24	39
		% within Group	20,7%	14,7%	12,9%	80,0%	31,5%
1		Count	23	29	27	6	85
		% within Group	79,3%	85,3%	87,1%	20,0%	68,5%
Total		Count	29	34	31	30	124
		% within Group	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	43,724 ^a	3	<,001
Likelihood Ratio	42,591	3	<,001
Linear-by-Linear Association	21,684	1	<,001
N of Valid Cases	124		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 9,12.

Table 29 – Crosstabulation analysis (score/group) of Study 2 (source: SPSS software)

As previously mentioned, G1 watched the video on a tablet, G2 on a laptop, G3 on a mobile phone (smartphone), and G4 was the control group.

Table 29 shows that the group with the highest percentage of right answers was G3 (87,1%), corresponding to the children who watched the educational video on a mobile phone. Apart from the control group (G4), G1 obtained the lowest percentage of right answers (79,3%), corresponding to the group that used the tablet. G2 had a percentage of right answers of 85,3%, corresponding to the group that watched the video on a laptop.

We ran an independent-sample proportions test for all the paired combinations between groups 1 to 4, aiming to compare the success rate of the groups (rate of right answers) and its statistical significance. Table 30 shows the summary of the results of this test, which we detail in Appendix 3.

TABLE 30

	G1	G2	G3
G2	G1 = G2 p-value > 0,05	-	-
G3	G1 = G3 p-value > 0,05	G2 = G3 p-value > 0,05	-
G4	G1 > G4 p-value < 0,001	G2 > G4 p-value < 0,001	G3 > G4 p-value < 0,001

Table 30 – Summary of the results of the independent-sample proportions test (paired between groups)
(source: the author)

Table 30 shows that G1, G2, and G3 performed better than G4, which we already expected, as G4 was the control group. G1, G2, and G3 had no significant differences in their success rates, meaning that the learning outcomes were similar. To assess the engagement between groups, we ran a One-Way ANOVA analysis for G1, G2, and G3. We did not include G4 because this group watched a different video than the others, using the same device as G2. Table 31 shows the results of this test.

TABLE 31

Descriptives								
Engagement								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	29	3,62	1,699	,316	2,97	4,27	2	8
2	34	3,47	1,522	,261	2,94	4,00	2	8
3	31	3,03	1,080	,194	2,64	3,43	2	6
Total	94	3,37	1,459	,150	3,07	3,67	2	8

ANOVA					
Engagement					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5,702	2	2,851	1,349	,265
Within Groups	192,266	91	2,113		
Total	197,968	93			

ANOVA Effect Sizes^{a,b}				
		Point Estimate	95% Confidence Interval	
			Lower	Upper
Engagement	Eta-squared	,029	,000	,109
	Epsilon-squared	,007	-,022	,090
	Omega-squared Fixed-effect	,007	-,022	,089
	Omega-squared Random-effect	,004	-,011	,047

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

Table 31 – One-way ANOVA analysis of engagement/group (source: SPSS software)

Even though G1 (tablet) demonstrated higher engagement ($\bar{x} = 3,62$) than the other groups, these results are not statistically significant, meaning that the three devices registered similar levels of engagement, as occurred with the learning outcomes. To assess if there was a correlation between engagement and the score, regardless of the device, we ran a bivariate correlations analysis. Table 32 shows the results of this test. We did not find statistically significant correlations between the score or engagement and the other available variables.

TABLE 32

		Engagement	Score S2
Engagement	Pearson Correlation	1	,296**
	Sig. (2-tailed)		<,001
	N	124	124
Score S2	Pearson Correlation	,296**	1
	Sig. (2-tailed)	<,001	
	N	124	124

** . Correlation is significant at the 0.01 level (2-tailed).

Table 32 – Results of the bivariate correlations analysis engagement/score (source: SPSS software)

Table 32 shows a positive correlation between the engagement and the overall score, suggesting that the participants who demonstrated more positive engagement salient behaviors scored more often. To verify how engagement influenced the score, we ran a crosstabs analysis between engagement and score. We also ran a chi-square test to verify whether the association between the variables was statistically significant. Table 33 shows the results of these tests.

TABLE 33

		Engagement								Total
		1	2	3	4	5	6	7	8	
Score S2 0	Count	1	21	13	3	0	1	0	0	39
	% within Engagement	100,0%	43,8%	35,1%	13,6%	0,0%	20,0%	0,0%	0,0%	31,5%
1	Count	0	27	24	19	6	4	3	2	85
	% within Engagement	0,0%	56,3%	64,9%	86,4%	100,0%	80,0%	100,0%	100,0%	68,5%
Total	Count	1	48	37	22	6	5	3	2	124
	% within Engagement	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14,370 ^a	7	,045
Likelihood Ratio	18,129	7	,011
Linear-by-Linear Association	10,797	1	,001
N of Valid Cases	124		

a. 10 cells (62,5%) have expected count less than 5. The minimum expected count is ,31.

Table 33 – Results of the crosstabulation analysis (engagement/score) (source: SPSS software)

The participants with four or more positive engagement behaviors (registering higher engagement) had higher success rates (rate of right answers) than those with less than four behaviors. These results are statistically significant ($P = 0,045$).

Discussion and preliminary conclusions

The present study aimed to investigate the differences in the learning outcomes and engagement with educational videos targeted at preschool children displayed on large, medium, and small screens. We prepared a video stimulus with cognitive and pedagogical strategies, as suggested by the results of Study 1, and displayed it to 124 Portuguese children on three different devices: a tablet (medium screen size), a laptop (large screen size), and a mobile phone (small screen size).

Table 34 presents the results of the validation of our hypotheses.

TABLE 34			
Hypotheses considering group conditions		Results	Remarks
H1	LO G1 > LO G2	False	G1 = G2
	LO G1 > LO G3		G1 = G3
H2	LO G2 = LO G3	True	
H3	ENG G1 > ENG G2	False	ENG G1 = ENG G2
	ENG G1 > ENG G3		ENG G1 = ENG G3
H4	ENG G2 = ENG G3	True	
H5	Engagement → Learning outcomes	True	

Table 34 – Hypotheses of the study, considering the group conditions (source: the author)

The results of this study suggest that there are no significant differences in the learning outcomes between devices with different screen sizes. As such, H1 was not validated, since the learning outcomes from the video displayed on the tablet were similar to those from the video displayed on the laptop and mobile phone. As the

laptop and the mobile phone resulted in similar learning outcomes, H2 was validated. Conversely to what studies with other types of media for children suggested, this study did not find differences in the engagement with devices with different screen sizes. As such, H3 was not validated, and H4 was validated.

Finally, regarding the relationship between engagement and learning outcomes, the results demonstrate that the participants who demonstrated higher engagement salient behaviors (at least four behaviors) had a higher rate of right answers, which suggests that engagement does influence the learning outcomes, regardless of the screen size of the device. Thus, H5 was validated.

Even though the present study has not found differences in the learning outcomes between devices with different screen sizes, it is necessary to conduct further research comparing devices with larger screen sizes than the laptop. This is because many children watch videos on digital streaming platforms on LCDs, for instance, given the possibility of connecting smart TV boxes.

Preliminary conclusions

From the results of the present study, we concluded that the learning outcomes from educational videos are independent of the screen size of the device in which they are displayed. This means that regarding the second level of the Learning Taxonomy of Bloom (“understanding”), vocabulary learning occurs similarly between small (smartphone), medium (tablet), and large (laptop) screen size devices.

Regarding the engagement, there are no statistically significant differences in the engagement levels between the devices children use for watching videos. Further studies should focus on other factors that can enhance engagement, such as interactive videos. Furthermore, this study proved that regardless of the device, engaged viewers have significantly higher learning outcomes than non-engaged, establishing a threshold of four positive salient behaviors per 01:07 minutes of video for learning from educational videos. Therefore, it is paramount to blend education and entertainment (edutainment) when producing educational videos. Finally, the present study can be replicated using a longer timeframe.

3.3. Study 3 – First-order editing techniques and learning from educational videos: the effects of using cuts and different shot types on preschool children

Learning from videos is especially challenging for young children since their cognitive structures and functioning are still developing, and learning depends on the cognitive processing of the educational content. Furthermore, young children have far less experience with audiovisual products than older viewers, which causes many editing techniques usually used in videos to be not comprehended.

These editing techniques are often used to create more engaging audiovisual products since they allow producers to combine shots that present different perspectives of the same object and compress time and space between scenes, among many other possibilities. Nonetheless, the abovementioned factors can reduce the intelligibility of videos targeted at young children, jeopardizing the learning experience.

As demonstrated in the literature, preschool children are slower than older viewers in making the transition between shots after a cut, tending to focus on the center of the screen instead of following the position of the elements that transit between shots (Kirkorian & Anderson, 2017). Similarly, even though zoom-ins and zoom-outs are not pointed out as problematic for comprehension because they imitate real-life eye movements, editing and shooting techniques such as pans are not comprehended by children under four years old due to the low capacity of their working memory (Diergarten, Möckel, Nieding & Ohler, 2017).

In addition, following the claim of some authors who posit that different formal features require different perceptual and cognitive skills to be processed and comprehended, editing techniques of second- and third-orders are more cognitively demanding than those of first-order. This is especially evident in what regards to the violations of these rules, such as in the use of reverse-angle shots, crosscuttings, flashbacks, and ellipsis (Pittorf, Lehmann & Huckauf, 2014).

Nonetheless, regarding younger children, even editing techniques that follow first-order rules can be challenging, even if the combination between shots preserves the continuity of the movement of an object on the screen. This is because the size discrepancy in the depiction of that object between wider and closer shots can be hard to process for those children who have not yet achieved the perceptual skill of size constancy, for instance (Kirbas & Smith, 2019).

Considering all these factors, we intended to investigate if different shot types affect the efficiency of educational videos for preschool children compared to a continuous take of a scene. Thus, in study 3.1, we prepared the video stimuli to be used in study 3.2, and in the latter, we investigated the impact on learning from educational videos.

Study 3.1

To prepare the materials for study 3.2, we first conducted the present exploratory study to investigate how some educational series edit and combine different shot types within their video segments. Thus, starting from an exploratory approach, we analyzed the formal features of videos from *Blue's Clues & You* and *Sesame Street*, given the proven results of these series in multiple domains of learning and cognitive development (Crawley et al., 2002; Anderson, Bryant, Wilder, Santomero, Williams & Crawley, 2000; Fisch & Truglio, 2001).

Materials

We chose the videos to be analyzed directly from the YouTube channels of *Blue's Clues & You* and *Sesame Street* since we were specifically looking for videos from these series. The criteria we used for this selection are described in Table 35.

TABLE 35		
Category	Include	Exclude
Educational videos from <i>Blue's Clues & You</i> and from <i>Sesame Street</i>	Videos labeled in the channel as educational	Videos labeled in the channel as other than educational (songs, nursery rhymes, storytelling segments, among others)
	Videos under 5 minutes	Videos above 5 minutes
	Recent videos (released from 2020 onwards)	Videos that were not recent (released before 2020)
	Videos with characteristics that promote learning	Videos without characteristics that promote learning

Table 35 – Inclusion/exclusion table for the selection of materials for study 3.1 (source: the author)

Following the criteria we used, the selected videos should be labeled on the channel as educational, be under 5 minutes long, and should have been released in or after 2020. Furthermore, these videos should have characteristics that promote learning, such as: the main character of both series should be human or human-like; the educational content should be presented in a clear and sequential narrative; the scenarios and contexts should be familiar to the children; the dialogues should be simple and easy to understand; there should be a well-defined curriculum; the main characters should interact with the viewers; the use of pedagogical strategies such as the explanation of new vocabulary should be evident.

Considering the abovementioned criteria, we chose a sample of six videos, three from *Blue's Clues & You* and three from *Sesame Street*. Table 36 presents a list of the videos that were analyzed.

TABLE 36			
Video no.	Series	Title	Total Length (mm:ss)
1	<i>Blue's Clues & You</i>	Musical Instrument Mix Up Game w/ Josh and Blue!	04:57
2	<i>Blue's Clues & You</i>	Learn How Oranges Grow w/ Josh, Blue, Mr. Salt & Mrs. Pepper!	04:40
3	<i>Blue's Clues & You</i>	Learn ASL w/ Josh & Blue Sign Language for Kids	04:23
4	<i>Sesame Street</i>	Colors Elmo's World	04:46
5	<i>Sesame Street</i>	Counting Elmo's World	04:46
6	<i>Sesame Street</i>	Instruments Elmo's World	04:46

Table 36 – List of the videos analyzed in study 3.1 (source: the author)

Procedure

To investigate the editing of the videos, we analyzed each shot individually, registering their length and type (full shot, cowboy shot, medium shot, medium closeup, closeup, or extreme closeup). Furthermore, since the videos were composed of different scenes, we grouped the scenes according to the following categories: “dialogue” (if the main character was present and speaking about a theme), “song,” “game,” and “other” (if the main character was not present and/or the scene focused on other elements).

Two researchers coded the data into categories. We calculated the percentage of agreement by dividing the number of agreements by the total number of scenes, obtaining a percentage of 96%. For the full list of shots and their codification into categories, please see Appendix 4.

After registering the data for each shot, we calculated the average shot length (ASL), and the standard deviation of the average shot length (SDASL) of each video. In addition, we analyzed the frequency of the shot types and the average shot length of

the dialogue scenes in each video since the objective of this study was to prepare the materials for Study 3.2, in which we would use video segments that only contained dialogues.

Results

The title, total length, average shot length (ASL), and standard deviation of the average shot length (SDASL) of each video are described in table 37.

TABLE 37					
Video no.	Series	Title	Total Length (mm:ss)	ASL (mm:ss)	SDASL (mm:ss)
1	<i>Blue's Clues & You</i>	Musical Instrument Mix Up Game w/ Josh and Blue!	04:57	00:24	00:23
2	<i>Blue's Clues & You</i>	Learn How Oranges Grow w/ Josh, Blue, Mr. Salt & Mrs. Pepper!	04:40	00:20	00:15
3	<i>Blue's Clues & You</i>	Learn ASL w/ Josh & Blue Sign Language for Kids Blue's Clues & You!	04:23	00:08	00:06
4	<i>Sesame Street</i>	Colors Elmo's World	04:46	00:06	00:09
5	<i>Sesame Street</i>	Counting Elmo's World	04:46	00:10	00:11
6	<i>Sesame Street</i>	Instruments Elmo's World	04:46	00:09	00:10

Table 37 – Details of the videos analyzed in the present study (title, length, ASL, and SDASL) (source: the author)

As mentioned previously, the analysis of the frequency of shot types and average shot length (individually) focused on the dialogue scenes in each video. The results suggest great variability in the frequency of shot types in the dialogue scenes of the episodes, both when comparing *Blue's Clues & You* with *Sesame Street* and between the episodes of each series (table 38).

TABLE 38						
	Cowboy shot	Full shot	Medium closeup	Medium shot	Closeup	Extreme closeup
<i>Blues's Clues & You</i> – Musical Instruments	1	1	1	7		
<i>Blues's Clues & You</i> – Oranges	5	1	5	1	2	
<i>Blues's Clues & You</i> – Sign Language			13	4	6	1
<i>Sesame Street</i> – Colors		1	6	1	3	
<i>Sesame Street</i> – Counting		1	7		2	
<i>Sesame Street</i> – Instruments		1	8		1	
Total	6	5	40	13	14	1

Table 38 – Frequency of each shot type per episode (source: the author)

Despite this variability, the shot type that is most used in both series is the medium closeup (ASL of 0:09 in *Blue's Clues and You* and 00:13 in *Sesame Street*), followed by medium shot (ASL of 00:13), and closeup (ASL of 0:08) (in the *Blue's Clues & You* episodes – figure 3), and by closeup (ASL of 0:05), and full shot (ASL of 00:24) (in the *Sesame Street* episodes – figure 4).

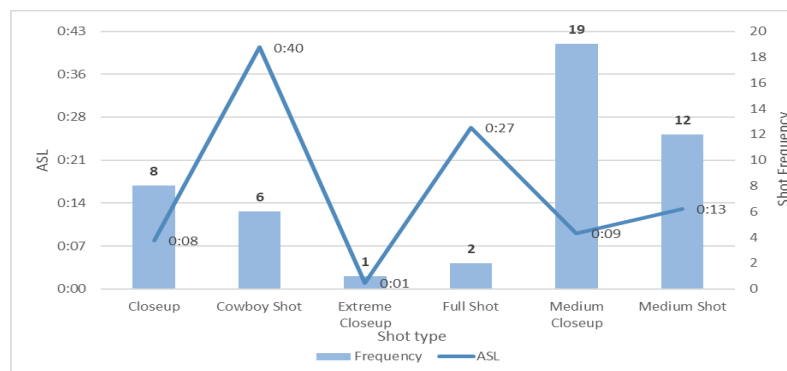


Figure 3 – Shot frequency and ASL of the dialogue scenes in all the analyzed videos from *Blue's Clues & You* (source: the author)

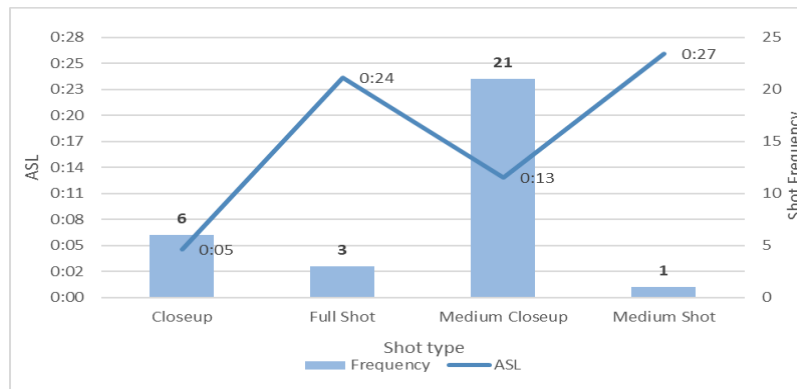


Figure 4 – Shot frequency and ASL of the dialogue scenes in all the analyzed videos from *Sesame Street*
(source: the author)

In the results we obtained, there can be seen a clear preference in both series for medium closeups, followed by closeups, medium shots, and full shots.

Even though the videos of *Blue's Clues & You* also included cowboy shots, this shot type was not present in *Sesame Street* videos, possibly because the main character in *Blue's Clues & You* is a boy in *Sesame Street* is a puppet. For this reason, we consider that the characteristics of the main character largely influence the choice of shot types used in educational videos.

In addition, in both series, there can be noticed that wider shots (e.g., full and medium shots) have a major average length than closer shots (e.g., closeups and medium closeups). This can be due to the fact that since wider shots allow the displaying of more elements on the screen, the editors decide to increase their length so that the viewers can process all the displayed information, but more research is needed to understand the choices of the editors.

Considering these results, we edited the video to be used as a video stimulus in study 3.2 as described in Table 39.

TABLE 39				
Shot no.	Scene Type	Shot Type	Shot Length	ASL
1	Dialogue	Full Shot	00:11	00:06
2	Dialogue	Medium Closeup	00:12	

3	Dialogue	Closeup	00:05
4	Dialogue	Full Shot	00:02
5	Dialogue	Medium Closeup	00:03
6	Dialogue	Full Shot	00:06
7	Dialogue	Medium Shot	00:07
8	Dialogue	Full Shot	00:08
9	Dialogue	Medium Shot	00:03
10	Dialogue	Full Shot	00:11
11	Dialogue	Medium Closeup	00:08

Table 39 – Details of the shots used in producing the video stimulus for study 3.2 (scene type, shot type, shot length, and ASL) (source: the author)

As presented in table 39, we edited our video recurring to the most common type of shots used in the episodes previously analyzed in this study, namely closeups, medium closeups, medium shots, and full shots. Although our main character was human, such as the one in *Blue's Clues & You*, we did not use cowboy shots because our character was sitting most of the time and not standing as the character in the episodes of that series. As our video comprised the illustration of vocabulary, we opted for more full shots and medium closeups, both with a larger ASL than in other shot types (figure 5).

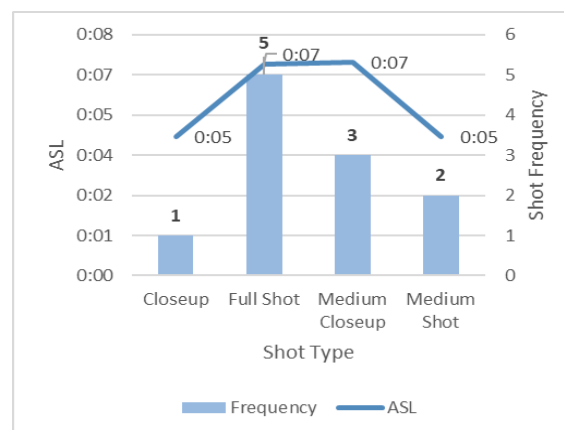


Figure 5 – Shot frequency and ASL of the video stimulus to be used in Study 3.2 (source: the author)

We conducted this exploratory study to investigate good editing practices in educational videos targeted at young children so that we could edit the video stimulus used in study 3.2. For that purpose, we analyzed six videos from *Blue's Clues & You* and *Sesame Street*, and we concluded that in dialogue scenes, the most used shot types were medium closeups, closeups, medium shots, and full shots. In addition, the obtained results suggested that wider shots usually have a larger ASL than closer shots.

As this study was relevant for editing the video to be used in study 3.2, we consider this type of analysis paramount in informing the production of educational videos for children.

Study 3.2

As previously mentioned, we intended to investigate the impact of combining different shot types on the efficiency of educational videos for preschool children compared to a continuous take of the same scene. Therefore, our research question was (RQ3.2) *Is the effectiveness of educational videos affected by using continuity editing?*

We hypothesized that (H1) the learning outcomes from a video edited in a wide shot (continuous shot) would be higher than those from a video edited with multiple shot types (wide and close).

Participants

We began with a sample of 112 children. Over the initial sample, we conducted two pre-tests, similarly to the procedure we adopted in Study 1 and Study 2 of this work. These pre-tests were on language skills and previous knowledge of the name of the rain stick. After the pre-test on language skills, 17 children were excluded from the participation in the study: 5 of 3 years old, 4 of 4 years old, and 8 of 5 years old.

TABLE 40				
Age	$\bar{X}$	SD	Min. threshold ($\bar{X}$ - SD)	No. excluded
3	6,935484	2,080633	4,854851213	5
4	7,939394	2,290461	5,648932824	4
5	8,833333	2,205731	6,627602564	8

Table 40 – Results of the language skills pre-test of Study 3.2 (source: the author)

Regarding the pre-test on the knowledge of the name of musical instruments, three children were excluded because they already knew the name of the rain stick. The final sample was composed of 92 children (48 boys and 44 girls, mean age = 4,18 years old) (table 41).

TABLE 41		
Age	Gender	No. of participants
3	Overall	23
	F	14
	M	9
4	Overall	29
	F	9
	M	20
5	Overall	40
	F	21
	M	19
Total		92

Table 41 – Final sample of the study (source: the author)

Sample characteristics

We asked a set of complementary demographic questions to the parents/caregivers of the children who participated in the study through a questionnaire we handed in. These questions regarded their place of residence, the household composition, the existence of siblings, and the level of education and age of the parents/caregivers. Our sample has the following characteristics:

(1) It is composed of 92 children between 3 and 5 years old, namely: 23 children of 3 years old (9 boys and 14 girls), 29 children of 4 years old (20 boys and 9 girls), and 40 children of 5 years old (19 boys and 21 girls).

(2) Most children live in the city of Torres Vedras and surrounding (38%).

(3) Most children live in a nuclear family (51%), with their parents and siblings (33%).

(4) Most parents/caregivers completed secondary or vocational education (33%), or hold a bachelor's degree (18%).

(5) Most parents/caregivers are in the age group of 30-39 years old (37%).

Table 42 summarizes the sample characteristics.

TABLE 42		
	N	%
Age		
3	23	25,00%
4	29	31,52%
5	40	43,48%
Gender		
Female	44	47,83%
Male	48	52,17%

Place of residence		
Lisbon Metropolitan Area	20	21,74%
Center (Torres Vedras)	35	38,04%
Don't know / No information	37	40,22%
Household composition		
Nuclear family	47	51,09%
Extended or joint family	6	6,52%
Single-parent family	1	1,09%
Reconstituted family	1	1,09%
Don't know / No information	37	40,22%
Siblings		
At least one sibling	30	32,61%
Only child	25	27,17%
Don't know / No information	37	40,22%
Level of education of the parents/caregivers		
Master's degree or Ph.D.	7	7,61%
Bachelor's degree	17	18,48%
Secondary/vocational education	30	32,61%
Primary education	1	1,09%
Don't know / No information	37	40,22%
Age groups of the parents/caregivers		
Less than 30 years old	5	5,43%
30-39 years old	34	36,96%
Above 40 years old	16	17,39%
Don't know / No information	37	40,22%

Table 42 – Sample characteristics of Study 3.2 (source: the author)

Video Stimuli

A video segment (V1) with a length of 00:01:14 was previously recorded, applying the following cognitive and pedagogical strategies: a sequential narrative, familiar scenarios, human or human-like characters, simple dialogues, a curriculum-oriented structure, interaction with the viewers, and explanation/illustration of the meaning of new vocabulary. The objective of the videos was to teach what a rain stick is, and the plot of the video segment (V1) is described in table 43 (to read the script, please see Appendix 1).

TABLE 43

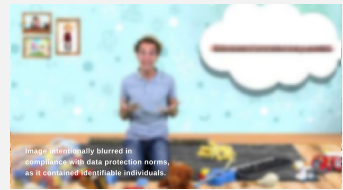
Video segment	Plot	Screenshot
V1	A male character is looking for his rain stick because he wants to make a soft sound with it. The scenario is at home, and the dialogues are easy. The meaning of new vocabulary is explained/illustrated, and the character interacts with the viewers. The curriculum goal is to teach what a rain stick is.	

Table 43 – Plot of the video segment (source: the author)

In the post-production (or editing) of the video segment, one version (V1) was edited as a continuous shot (full shot), and another version (V1.1) was edited with a combination of medium closeups, closeups, medium shots, and full shots (please see Study 3.1 in this work) (Link to V1: <https://youtu.be/OyCYfvXXSuM>; link to V1.1: https://youtu.be/te48z_9c2X0).

Procedure

The participants were randomly assigned to one of three groups (G1, G2, and G3). Groups 1 and 2 corresponded to the displaying of one of the different video segments (V1 and V1.1), and G3 corresponded to the control group, to which we

displayed a video segment of a cartoon unrelated to music education (link to the video: <https://youtu.be/DDX0XuEMomY>). To each participant in each group, we played the correspondent video segment on a laptop (13 inches screen and HD resolution) in rooms with identical displaying conditions.

After displaying the videos, we presented to the children a tray with images of six musical instruments, which contained the image of the rain stick, the maraca, the ukulele, the kazoo, the flute, and the piano. Once the child was paying attention to them, we asked: “Where is the rain stick?”. The question was repeated until the child pointed at one of the images, or after 1 minute with no answers.

After this procedure, for the children that pointed at the rain stick, we said: “Let’s play one more time!”. Then, we presented the images a second time, in a different order, asking the same question, “Where is the rain stick?”. Once again, the question was repeated until the child chose an object, or after 1 minute with no answers.

This procedure had already been used in Study 1 and Study 2 of this work, and it was adapted from studies on the field of vocabulary learning from educational videos on young children (e.g., Krcmar & Cingel, 2017; O’Doherty, Troseth, Shimpi, Goldenberg, Ahktar & Saylor, 2011).

Scoring procedure

If the children pointed twice at the rain stick (the right image), 1 point was given. Otherwise, no points were given.

Results

We prepared a database with the data we collected, using the following fields: age, group, and score. In addition, to search for correlations between the variables, we added information from the survey to which the families responded regarding the age

of the parents, consumption frequency of educational videos, siblings, and use frequency of the smartphone, the tablet, and the computer. After this procedure, we conducted the statistical analysis on SPSS software.

Table 44 presents the hypothesis of the present study with the group conditions.

TABLE 44	
	Hypotheses considering group conditions
H1 LO video with a continuous shot (wide shot) > LO edited video with multiple shot types (wide and close)	LO G1 > LO G2

Table 44 – Hypothesis of the present study, considering the group conditions (source: the author)

Firstly, we ran a crosstabs analysis with the fields of score and group to obtain an overall view of the percentage of right and wrong answers per group. In addition, we ran a chi-square test to verify if the association between the variables is statistically significant. We present the results in Table 45.

TABLE 45

ScoreS3 * Group Crosstabulation

		Group			
		1	2	3	Total
ScoreS3	0	Count	1	0	19
		% within Group	2,9%	0,0%	63,3%
	1	Count	33	28	11
		% within Group	97,1%	100,0%	36,7%
Total		Count	34	28	30
		% within Group	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	45,347 ^a	2	<,001
Likelihood Ratio	47,887	2	<,001
Linear-by-Linear Association	32,433	1	<,001
N of Valid Cases	92		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 6,09.

Table 45 – Crosstabulation (score/group) (source: SPSS software)

As previously mentioned, G1 watched the not-edited video (continuous shot), G2 watched the edited video (using wide and close shots), and G3 was the control group.

Table 45 shows that G1 and G2 had a similar performance. G1 had a success rate of 97,1%, and G2 of 100%. Both groups showed higher learning outcomes than G3 (36,7%).

To compare the success rate between groups and verify the statistical significance of this comparison, we ran an independent-sample proportions test for all the paired combinations between groups 1 to 3. Table 46 summarizes the results of this test (for detailed results, please see Appendix 5).

TABLE 46

	G1	G2
G2	G1 = G2 p-value > 0,05	-
G3	G1 > G3 p-value < 0,001	G2 > G3 p-value < 0,001

Table 46 – Summary of the results of the independent-sample proportions test (paired between groups)
(source: the author)

As Table 46 shows, when comparing the performance between G1 and G2 and analyzing the statistical significance, the groups had similar learning outcomes, conversely to what we hypothesized. In addition, they both outperformed G3, which we already expected, given that G3 was the control group. We did not find statistically significant correlations between the score and the other available variables.

Discussion and preliminary conclusions

We conducted the present study to investigate if the use of editing, alternating closer and wider shots, undermined learning from educational videos compared to not edited videos, i.e., videos using a continuous shot. Given that the literature suggests

that younger children are still developing several cognitive and perceptual structures necessary for understanding editing in videos, we aimed to investigate if producers can use editing techniques following first-order editing rules to achieve more visual dynamics or if this can jeopardize the learning experience.

We assessed the learning outcomes with 92 Portuguese children. Table 47 presents the results of the validation of our hypothesis.

TABLE 47				
		Hypotheses considering group conditions	Results	Remarks
H1	LO video with continuous shot (wide shot) > LO edited video with multiple shot types (wide and close)	LO G1 > LO G2	False	LO G1 = LO G2

Table 47 – Hypothesis of the present study, considering the group conditions (source: the author)

As Table 47 shows, H1 was not validated since the learning outcomes from the edited version of the video were similar to those from the not edited version.

The results of this study suggest that editing techniques that follow the first-order editing rules (such as cuts, alternating closer with wider shots) are not problematic for preschool children to learn from educational videos. This is valid if the videos encompass cognitive and pedagogical strategies and the characters (and other relevant visual information) are centered on the screen, which was the condition of the present study.

Furthermore, the use of different shot sizes can provide more visual dynamics to the videos and make them more interesting for the viewers, possibly retaining the attention of the children for more time in longer videos. Further research is necessary to understand if the use of cuts and different shot sizes is related to a higher engagement and enjoyment with educational videos.

Preliminary conclusions

The present study demonstrated that learning outcomes are similar between not edited videos (using a continuous shot) and edited videos (combining different shot types between wider and closer shots). The participants in both group conditions had a very high success rate. One possible explanation for such a result is that regarding vocabulary learning at the second level of the Learning Taxonomy of Bloom (“understanding”), the cognitive load in processing first-order editing techniques and different shot sizes does not disrupt the learning experience.

Furthermore, exposure to audiovisual content is mentioned in the literature as one factor that improves media sign literacy and consequently fosters the comprehension of editing techniques and integration of different shot types. Portuguese children are nowadays highly exposed to audiovisual media on digital platforms from a very young age, especially regarding entertainment productions using different editing techniques. As a result, they acquire media sign literacy from a very young age.

This study proved that preschool children can process first-order editing techniques (cuts) and integrate different shot types, which enables learning from edited videos if the characters and other relevant visual information are centered on the screen (the condition in our study). Further research should consider the relationship between the comprehension of editing techniques and the level of exposure to audiovisual media of children, regardless of the type of content.

3.4. Study 4 – Does the source language matter for learning? The impact of dubbing educational videos for preschool children on learning outcomes

Congruence, i.e., the synchrony between the audio and image sources of a video, is paramount for learning because when these two sources are not synched, the cognitive load of the working memory increases, jeopardizing the learning experience (Lange & Costley, 2020).

Dubbing requires overlapping an audio source with another. This process always implies a lack of synchrony between audio and video information because the lip movements in the source language are necessarily different in the target language, even if dubbing specialists pay attention to detail and follow some principles such as lip synchrony, kinetic synchrony, and isochrony.

The literature suggests that adult viewers adopt an unconscious strategy of avoiding looking at the mouth of the characters in a dubbed video, which is fundamental for comprehending it (the so-called “dubbing effect”) (Romero-Fresco, 2020). This is because the brain prioritizes the visual information over the auditory, meaning that viewers tend to process what they see instead of what they hear (the “McGurk effect”) (Smith, Duede, Hanrahan, Davis, House & Greger, 2013). This mismatch compromises comprehension, especially in closer shots, where the lip movements are seen more clearly.

Some authors claim that the McGurk effect only develops in late childhood (see Hirst, Stacey, Cragg, Stacey & Allen, 2018), but it remains unclear if dubbing practices affect the comprehension of videos for young children. Thus, the present study aimed to investigate the impact of dubbing on learning from educational videos.

We started from the research question (RQ3.3) *Are dubbed educational videos as effective as not dubbed educational videos?*

We hypothesized that (H1) the learning outcomes of the not dubbed videos would be higher than those of dubbed videos; and (H2) the learning outcomes from

dubbed videos with a continuous shot would be higher than from dubbed videos edited with closer shots.

Participants

We began with a sample of 150 children. Over the initial sample, we conducted two pre-tests: one on language skills, and another one on previous knowledge of the name of the maraca, given that this study assessed the learning of its name through an educational video. This procedure was already applied in Study 1, Study 2, and Study 3.2 of this work.

After applying the pre-test on language skills, 29 children were excluded from the study: 7 of 3 years old, 9 of 4 years old, and 13 of 5 years old (table 48).

TABLE 48				
Age	$\bar{X}$	SD	Min. threshold ($\bar{X}$ - SD)	No. excluded
3	6,75	2,22172152	4,52827848	7
4	8,181818182	2,071655077	6,110163105	9
5	8,516129032	2,193447287	6,322681746	13

Table 48 – Results of the language skills pre-test of Study 4 (source: the author)

In addition, after the application of the pre-test on previous knowledge of the name of the maraca, we excluded 44 children from the study because they already knew it. Therefore, the final sample was composed of 77 children (45 boys and 32 girls, mean age = 4,05 years old) (table 49).

TABLE 49		
Age	Gender	No. of participants
3	Overall	23
	F	12
	M	11
4	Overall	27
	F	9
	M	18
5	Overall	27
	F	11
	M	16
Total		77

Table 49 – Final sample of the study (source: the author)

Sample characteristics

A set of complementary demographic questions were asked through a questionnaire given to the parents/caregivers. These questions regarded the place of residence, household composition, siblings of the children, the level of education of the parents/caregivers, and the age of the parents/caregivers. From the answers we obtained to the questionnaire, our sample is characterized as follows:

(1) It is composed of 77 children between 3 and 5 years old, namely: 23 children of 3 years old (11 boys and 12 girls), 27 children of 4 years old (18 boys and 9 girls), and 27 children of 5 years old (16 boys and 11 girls).

(2) Most children live in the city of Torres Vedras and surroundings.

(3) Most children live in a nuclear family (64,9%) and have siblings (46,8%).

(4) Most parents/caregivers completed secondary or vocational education (33,8%) or hold a bachelor's degree (24,7%).

(5) Most parents/caregivers are in the age group of 30-39 years old (42,9%).
The sample characteristics are summarized in Table 50.

TABLE 50		
	N	%
Age		
3	23	29,87%
4	27	35,06%
5	27	35,06%
Gender		
Female	32	41,56%
Male	45	58,44%
Place of residence		
Lisbon Metropolitan Area	22	28,57%
Center (Torres Vedras)	33	42,86%
Don't know / No information	22	28,57%
Household composition		
Nuclear family	50	64,93%
Extended or joint family	3	3,90%
Single-parent family	2	2,60%
Don't know / No information	22	28,57%
Siblings		
At least one sibling	36	46,75%
Only child	19	24,68%

Don't know / No information	22	28,57%
Level of education of the parents/caregivers		
Master's degree or Ph.D.	8	10,39%
Bachelor's degree	19	24,68%
Secondary/vocational education	26	33,77%
Primary education	2	2,60%
Don't know / No information	22	28,57%
Age groups of the parents/caregivers		
Less than 30 years old	5	6,49%
30-39 years old	33	42,86%
Above 40 years old	17	22,08%
Don't know / No information	22	28,57%

Table 50 – Sample characteristics of Study 4 (source: the author)

Video Stimuli

Two video segments (V1 and V1.1) were previously recorded, applying the following cognitive and pedagogical strategies: a sequential narrative, familiar scenarios, human or human-like characters, simple dialogues, a curriculum-oriented structure, interaction with the viewers, and explanation/illustration of the meaning of new vocabulary. The length of the videos was 00:01:13 and 00:01:07, respectively. The objective of the videos was to teach what a maraca is. V1 was recorded in Portuguese, and V1.1 was recorded in English and dubbed in Portuguese in the post-production. The plot of the video segments (V1 and V1.1) is described in Table 51 (for reading the scripts, please see Appendix 1).

TABLE 51

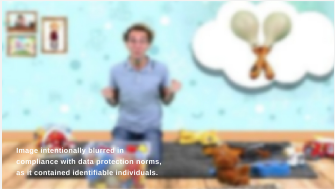
Video segment	Plot and hyperlink	Screenshot
V1; V1.1	A male character is looking for his maraca because he wants to play a rhythm with it. The scenario is at home, and the dialogues are easy. The meaning of new vocabulary is explained/illustrated, and the character interacts with the viewers. The curriculum goal is to teach what a maraca is. Link to V1: https://youtu.be/IZUTf2ZFJd4 Link to V1.1: https://youtu.be/n_H-ULsuLDA	

Table 51 – Plot of the video segments (source: the author)

In addition, another version, V1.2, was created starting from V1.1 by editing the latter using a combination of medium closeups, closeups, medium shots, and full shots, following the same editing procedure used for preparing the materials for Study 3.2 of this work (link to V1.2: <https://youtu.be/9PccwhuOi88>).

Procedure

The participants were randomly assigned to one of four groups (G1, G2, G3, and G4). Groups 1 to 3 corresponded to displaying one of the different video segments (V1, V1.1, and V1.2), and G4 corresponded to the control group, to which we displayed a video segment of a cartoon unrelated to music education link to the video: (<https://youtu.be/DDX0XuEMomY>).

To each participant in each group, we played the correspondent video segment on a laptop (13 inches screen and HD resolution) in rooms with identical displaying conditions. After viewing the video, we presented the image of the maraca and five other musical instruments: the ukulele, the rain stick, the flute, and the piano. After presenting the images and once the child paid attention to them, we asked: “Where is the maraca?”. The question was repeated until the child pointed at one of the images, or after 1 minute with no answers.

After this procedure, we said, “Let’s play one more time!” to the children that pointed at the maraca. Then, we presented the images a second time, in a different order, asking the same question, “Where is the maraca?”. Once again, the question was repeated until the child chose an object, or after 1 minute with no answers.

We used this procedure also in Study 1, Study 2, and Study 3 of this work, and it was adapted from studies with young children on word learning from educational videos (e.g., Krcmar & Cingel, 2017; O’Doherty, Troseth, Shimpi, Goldenberg, Ahktar & Saylor, 2011).

Scoring procedure

Considering the answers that were given by the children when asked “Where is the maraca” if they pointed twice at the rain stick (the right image), 1 point was given. Otherwise, no points were given.

Results

We prepared a database with the collected data for this study, using the following fields: age, group, and score. Additionally, we inserted the following fields: age of the parents, consumption frequency of educational videos, siblings, and use frequency of the smartphone, tablet, and computer. The source of the latter fields was the demographic survey we delivered to the families, and we added them to search for correlations between all the available variables. As some families did not respond to all the items, we erased the missing values. We ran the statistical analysis on SPSS software. Table 52 presents the hypotheses of the present study with the group conditions.

TABLE 52

		Hypotheses considering group conditions
H1	LO not dubbed videos > LO dubbed videos	LO G1 > LO G2 and LO G1 > LO G3
H2	LO dubbed videos (continuous shot) > LO dubbed videos (edited)	LO G2 > LO G3

Table 52 – Hypotheses of the study, considering the group conditions (source: the author)

We began by running a crosstabs analysis with the fields of score and group, aiming to obtain an overall view of the performance of each group. In addition, we ran a chi-square test to verify if the association between the variables is statistically significant. We present the results in Table 53.

TABLE 53

ScoreS4 * Group Crosstabulation							
		Group					
		1	2	3	4	Total	
ScoreS4	0	Count	0	1	2	15	18
		% within Group	0,0%	6,3%	9,1%	68,2%	23,4%
	1	Count	17	15	20	7	59
		% within Group	100,0%	93,8%	90,9%	31,8%	76,6%
Total		Count	17	16	22	22	77
		% within Group	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	34,970 ^a	3	<,001
Likelihood Ratio	35,336	3	<,001
Linear-by-Linear Association	24,275	1	<,001
N of Valid Cases	77		

a. 2 cells (25,0%) have expected count less than 5. The minimum expected count is 3,74.

Table 53 – Crosstabulation (score/group) (source: SPSS software)

As previously mentioned, G1 watched the not dubbed video (with the original audio in Portuguese), G2 watched the dubbed video (original audio in English and dubbed to Portuguese), G3 watched the dubbed video using closer shots), and G4 was the control group.

Table 53 shows that the group with the highest rate of right answers was G1 (not dubbed video – 100%), followed by G2 (dubbed video – 93,8%), and G3 (dubbed video edited with closer shots – 90,9%). G4 (control group) obtained the lowest success rate (31,8%).

To compare the success rate between groups and verify its statistical significance, we ran an independent-sample proportions test for all the paired combinations between groups 1 to 4. Table 54 presents the summary of the results of the test, which we detail in Appendix 6.

TABLE 54

	G1	G2	G3
G2	G1 = G2 p-value > 0,05	-	-
G3	G1 = G3 p-value > 0,05	G2 = G3 p-value > 0,05	-
G4	G1 > G4 p-value < 0,001	G2 > G4 p-value < 0,001	G3 > G4 p-value < 0,001

Table 54 – Summary of the results of the independent-sample proportions test (paired between groups)
(source: the author)

Table 54 shows that G1, G2, and G3 presented a higher success rate than G4, which we already expected since G4 was the control group. Nevertheless, conversely to what we expected, G1, G2, and G3 showed a similar performance regarding the learning outcomes. Despite not being statistically significant, we noticed that 4- and 5-year-old children slightly underperformed in G3, corresponding to the edited dubbed version (with closer shots), as Table 55 shows.

TABLE 55

ScoreS4 * Group * Age Crosstabulation								
Age				Group				Total
				1	2	3	4	
3	ScoreS4	0	Count	0	1	0	4	5
			% within Group	0,0%	14,3%	0,0%	66,7%	21,7%
	1		Count	4	6	6	2	18
			% within Group	100,0%	85,7%	100,0%	33,3%	78,3%
	Total		Count	4	7	6	6	23
			% within Group	100,0%	100,0%	100,0%	100,0%	100,0%
4	ScoreS4	0	Count	0	0	1	5	6
			% within Group	0,0%	0,0%	14,3%	71,4%	22,2%
	1		Count	6	7	6	2	21
			% within Group	100,0%	100,0%	85,7%	28,6%	77,8%
	Total		Count	6	7	7	7	27
			% within Group	100,0%	100,0%	100,0%	100,0%	100,0%
5	ScoreS4	0	Count	0	0	1	6	7
			% within Group	0,0%	0,0%	11,1%	66,7%	25,9%
	1		Count	7	2	8	3	20
			% within Group	100,0%	100,0%	88,9%	33,3%	74,1%
	Total		Count	7	2	9	9	27
			% within Group	100,0%	100,0%	100,0%	100,0%	100,0%
Total	ScoreS4	0	Count	0	1	2	15	18
			% within Group	0,0%	6,3%	9,1%	68,2%	23,4%
	1		Count	17	15	20	7	59
			% within Group	100,0%	93,8%	90,9%	31,8%	76,6%
	Total		Count	17	16	22	22	77
			% within Group	100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

Age		Value	df	Asymptotic Significance (2-sided)
3	Pearson Chi-Square	10,125 ^b	3	,018
	Likelihood Ratio	10,705	3	,013
	Linear-by-Linear Association	5,421	1	,020
	N of Valid Cases	23		
4	Pearson Chi-Square	13,776 ^c	3	,003
	Likelihood Ratio	14,487	3	,002
	Linear-by-Linear Association	10,025	1	,002
	N of Valid Cases	27		
5	Pearson Chi-Square	11,957 ^d	3	,008
	Likelihood Ratio	13,167	3	,004
	Linear-by-Linear Association	8,235	1	,004
	N of Valid Cases	27		
Total	Pearson Chi-Square	34,970 ^a	3	<,001
	Likelihood Ratio	35,336	3	<,001
	Linear-by-Linear Association	24,275	1	<,001
	N of Valid Cases	77		

a. 2 cells (25,0%) have expected count less than 5. The minimum expected count is 3,74.

b. 7 cells (87,5%) have expected count less than 5. The minimum expected count is ,87.

c. 5 cells (62,5%) have expected count less than 5. The minimum expected count is 1,33.

d. 5 cells (62,5%) have expected count less than 5. The minimum expected count is ,52.

Table 55 – Crosstabulation analysis (score/group) layered by age (source: SPSS software)

We did not find statistically significant correlations between the score and other available variables.

Discussion and preliminary conclusions

In the present study, we investigated if dubbed educational videos result in lower learning outcomes for preschool children than not dubbed educational videos, especially if producers use closer shots in which the lip movements are more visible than in wider shots. For our investigation, we prepared three video stimuli: a video recorded and displayed in Portuguese, a video recorded in English and dubbed to Portuguese, and a second version of the dubbed video, edited, alternating closer and wider shots. We assessed the learning outcomes from the different video stimuli with 77 Portuguese children. Table 56 presents the results of the validation of our hypotheses.

TABLE 56				
		Hypotheses considering group conditions	Results	Remarks
H1	LO not dubbed videos > LO dubbed videos	LO G1 > LO G2 and LO G1 > LO G3	False	LO G1 = LO G2 LO G1 = LO G3
H2	LO dubbed videos (continuous shot) > LO dubbed videos (edited)	LO G2 > LO G3	False	LO G2 = LO G3

Table 56 – Hypotheses of the study, considering the group conditions (source: the author)

The results of this study suggest that there are no differences in the learning outcomes between the original and the dubbed versions of educational videos, even if producers use closer shots. Nevertheless, we noticed that 4- and 5-year-old children slightly underperformed in the edited dubbed version condition of the study, which suggests that these can be critical ages for watching dubbed products, even though we did not find statistical relevance possibly due to the small size of our sample. As the literature suggests, the McGurk effect develops in late childhood (Hirst, Stacey, Cragg, Stacey & Allen, 2018), and therefore watching dubbed videos should not be a problem for young children. Notwithstanding, it remains unclear if by 4 or 5 years old it already

occurs to some extent, which can hinder the comprehension of videos and consequently jeopardize the learning experience.

Research on this topic is especially relevant given that there is a vast abundance of dubbed content on digital streaming platforms given that dubbed products are easier to export to other markets. Since learning from videos is especially demanding for young children because their cognitive structures are still developing, it is paramount to understand if dubbed content is appropriate for all ages or if it is fundamental to increase the support of local productions.

Preliminary conclusions

The present study demonstrated that dubbing does not affect learning from educational videos targeted at preschool children regarding vocabulary learning at the second level of the Learning Taxonomy of Bloom (“understanding”). These results suggest that the McGurk effect is not yet present in preschool children, meeting the conclusions of previous studies and validating the use of dubbing on educational videos if necessary (to facilitate the exportation to other markets, for instance).

Further studies should focus on assessing learning outcomes at other levels of the Learning Taxonomy of Bloom. In addition, as the literature does not present evidence yet for when the dubbing effect begins to develop (the unconscious strategy that adult viewers adopt of looking at the eyes of the characters instead of their mouths), further studies using eye-tracking technology are necessary to understand what occurs in young children. Finally, future research should replicate this study with a more significant sample and a more comprehensive age range to investigate a possible threshold age for learning from dubbed educational videos.

3.5. Study 5 – Bypassing the algorithm? Exploring the potential of families to increase the visibility of educational content for children

Digital video streaming platforms such as YouTube afford the possibility of distributing audiovisual content in an unprecedented manner since everyone can upload content and access it. This disruption of the traditional distribution model represents a significant opportunity for independent creators and producers of audiovisual media for children, who otherwise would be dependent on intermediaries to reach their target audiences.

Given this possibility, there is a wide abundance of the available content on these platforms. Nonetheless, this abundance has both good and bad effects: on the one hand, it increases the diversity of the content; on the other hand, it negatively affects the visibility of the content since the algorithms that recommend videos to the users present different results for different viewers, according to their estimated preferences and online behaviors (see McKelvey & Hunt, 2019).

Therefore, one of the significant challenges that digital streaming platforms represent for creators and producers is the discoverability of their products, making it necessary to adopt strategies for increasing the visibility of their content to their target audiences (Mazzoli, 2020).

This challenge can be addressed by creating a community of viewers since fans and friends contribute to disseminating media objects, both by sharing content and interacting with it, increasing its visibility and spreading (McKelvey & Hunt, 2019). Furthermore, the recommendation of content by friends in digital social media has a major weight on consumer choices than the recommendation made by the algorithms of digital platforms (Nikolic, 2017).

Thus, to reach their target audiences, it is paramount that creators and producers adopt a transmedia strategy, i.e., releasing on different media content linked by a core narrative, to reinforce their products on the different platforms that their audiences use.

For the design of a transmedia strategy, it is fundamental to consider the importance of participatory cultures (Jenkins, 2006), i.e., the dynamics in which the consumers abandon their role as receivers to interact with the content they consume and produce new content. In addition, it is of great importance to consider the attraction and engagement of audiences through transmedia interactivity (Phillips, 2012), i.e., the dynamics of consumption and interaction with content in different media platforms and channels.

Different target audiences have different media behaviors. Thus, it is necessary to acknowledge their habits to design an efficient transmedia strategy. This acknowledgment should regard how they interact with media content and how they use digital platforms, given that users change their media habits systematically with the introduction of new technologies (Bernardo, 2014).

This matter is relevant especially regarding preschool children. Even though they are the target audience of the products aimed at them, the users of digital platforms are the adults that supervise them, such as families and kindergarten teachers. Therefore, it is crucial to acknowledge how they access content and their preferences.

Taking the consumption of educational videos and family mediation as a starting point, we conducted an exploratory study among Portuguese families with preschool children. This study had the objective of addressing, from the perspective of an audiovisual media producer, the following main research question (RQ5) *What are the dynamics of Portuguese families in consuming educational videos and related transmedia content?*

As this topic is considerably wide, we divided it into three narrower research questions:

(RQ5.1) *Which digital platforms do Portuguese families prefer for consuming educational videos, how and how often do they interact with digital streaming platforms, and through which devices?*

(RQ5.2) *Which aspects do Portuguese families most appreciate in educational videos for preschool children?*

(RQ5.3) *From a transmedia approach, how often do families search for content related to educational videos for children on websites and/or social media profiles? What content do they value the most besides the educational videos?*

Materials and procedure

We adopted the questionnaire of Wartella, Rideout, Lauricella & Connell (2014), which was used primarily to investigate how American families were integrating digital media into their family dynamics and their parental practices. Dias & Brito (2018) translated it to Portuguese and used it to investigate how Portuguese families use digital media at home in what regards to mobile devices and applications.

For the present study, we adapted the Portuguese version of Dias & Brito (2018) to the topic of educational videos, and this adaptation led to a new questionnaire (please see Appendix 7). To validate our adaptation, we conducted a pre-test among 30 participants. After its validation, we distributed the questionnaire to a wider sample.

Participants

We recruited 134 families with preschool children (3-5 years old) through kindergartens in the area of Lisbon and Torres Vedras. We included families with different household compositions (nuclear, single-parent, extended or joint, and reconstituted families) who gave informed consent to participate in the study.

Considering the answers we obtained, our sample has the following characteristics:

(1) Most participants live in a nuclear family (84%), i.e., a household composed of a mother, father, and at least one preschool child.

(2) About two-thirds of the sample is in the age group of 30-39 years old, and most of the respondents are female (84%), confirming a major availability of mothers to answer this type of survey (Ponte et al., 2017).

(3) 62% of the families are from the city of Torres Vedras and its surroundings, and 47% live in the Lisbon Metropolitan Area.

(4) Overall, most families have a level of education surpassing the compulsory education in Portugal.

The analysis of the answers given to the questionnaire indicates that the respondents are young adults with preschool children with high levels of education, who already grew up within a digital environment. Table 57 summarizes the sample characteristics.

TABLE 57		
	N	%
Age group		
Less than 30 years old	13	9,70%
30-39 years old	85	63,43%
Above 40 years old	36	26,87%
Gender		
Female	113	84,33%
Male	21	15,67%
Place of residence		
Lisbon Metropolitan Area	47	35,07%
Center (Torres Vedras)	83	61,94%
Don't know / No information	4	2,99%
Household composition		
Nuclear family	112	83,58%
Extended or joint family	8	5,97%

Single-parent family	6	4,48%
Reconstituted family	4	2,99%
Don't know / No information	4	2,99%
Level of education of the parents/caregivers		
Master's degree or Ph.D.	19	14,18%
Bachelor's degree	40	29,85%
Secondary/vocational education	66	49,25%
Primary education	5	3,73%
Don't know / No information	4	2,99%

Table 57 – Sample characteristics of Study 5 (source: the author)

Results

In this section, we present the results of the descriptive statistical analysis we ran on SPSS (frequency), which we detail in Appendix 8. The results demonstrate that the platform families most use for searching for videos is YouTube. This platform is used by almost all the families of the sample (95%). The search engine Google is also used for this purpose, but by far fewer families (31%). The remaining platforms are irrelevant.

Although less than one-fifth of the families (18%) search for educational videos daily, more than half of the sample (53%) use the Internet for this purpose several times a week.

Families use keywords for searching for educational videos for children. To acknowledge the search themes and their relevance, in one of our survey questions, we asked the families to indicate which keywords they use when searching for educational videos (Appendix 7, question 6). To analyze this item, we created thematic categories from the mentioned keywords (Table 58). Two independent researchers coded the keywords into the themes, obtaining a percentage of agreement of 92%.

TABLE 58	
Category	Keywords used by families
Education (general)	Learning; colors; animals; English; French; maths; numbers; science; educational; alphabet; rhymes; emotions; differences; DIY (do it yourself); letters; reading; counting; how to; shapes
Dance	Dance; choreography; dancing
Music	Music; songs; rhythm; sounds; instruments
Visual arts	Drawing; draw; origami; painting; paintings; coloring pages; crafts
Cartoons	[Name of the cartoon]; cartoons
Games	Games; play
Other	Stories; fairy tales; [the age of the child]; [language of the video]; creativity; focus

Table 58 – Description of the terms identified in the keywords and their categorization (source: the author)

The theme of general education is the most mentioned (with 178 entries), which was anticipated given that educational videos are the object of the present study and the participants knew it. After general education, the participants mentioned keywords related to artistic education (with 80 entries). Within this topic are dance (18 entries), music (46 entries), and visual arts (16 entries).

Regarding the recommendation sources of videos, two-thirds of the participants highlighted the role of friends and relatives (67%). Kindergarten teachers also play an important role in recommending videos, being mentioned by about one-third of the families (34%). Social media, blogs, websites, and recommendations from other videos are mentioned only by one-fourth of the families.

The most valued aspects of educational videos for children are *safety*, mentioned by 81% of the participants, and the *development of artistic skills*, mentioned by 72%. About half of the sample appreciates aspects such as being *fun* (51%), *developing school readiness* (54%), developing sociocultural skills (49%), and *being starred by characters the child already knows* (42%). *Being a video from a brand*

the child already knows was little mentioned by the participants, demonstrating that commercial pressure is not valued.

Dynamics of consumption of transmedia content related to educational videos

Regarding the dynamics of the consumption of transmedia content, the families visit websites and social media profiles dedicated to educational videos occasionally. In what concerns social media profiles, about one-fourth of the sample does not visit them at all. In turn, more than half of the participants frequently search for transmedia content related to educational videos on websites (figure 6).

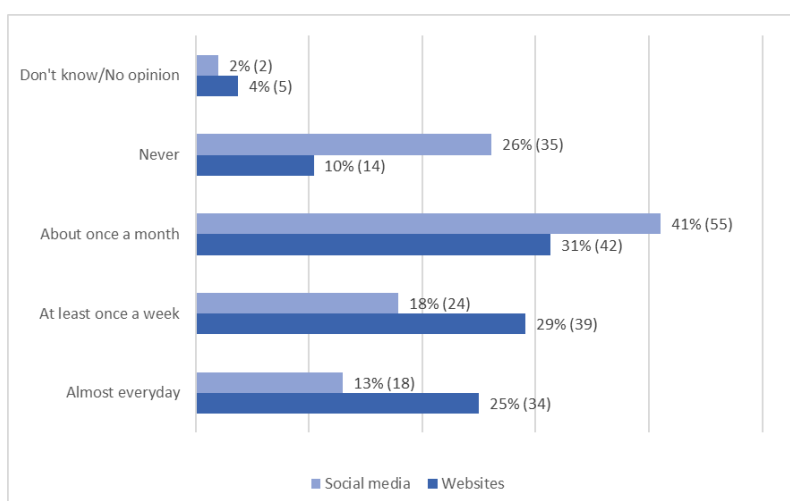


Figure 6 – Visit frequency to websites and social media profiles dedicated to educational videos for children (source: the author)

On websites dedicated to educational videos, most participants value entertainment content, such as games (54%) and coloring pages (51%), which is an activity that contributes to developing fine motor skills. Information about activities for the whole family is also valued (46%). In turn, information about new videos being produced (1%) and buying merchandise (4%) are not relevant reasons for visiting.

In Figure 7, we compare the content preferences in websites and social media profiles dedicated to educational videos mentioned by the participants in a multiple-choice item of the questionnaire. While games, coloring pages, and activities for the

whole family stand out, one-third of the sample searches for recommendations for parents in both media, and about one-fourth searches for information about related activities, such as concerts and theatre plays. Information related to the production of new videos and merchandise are undervalued.

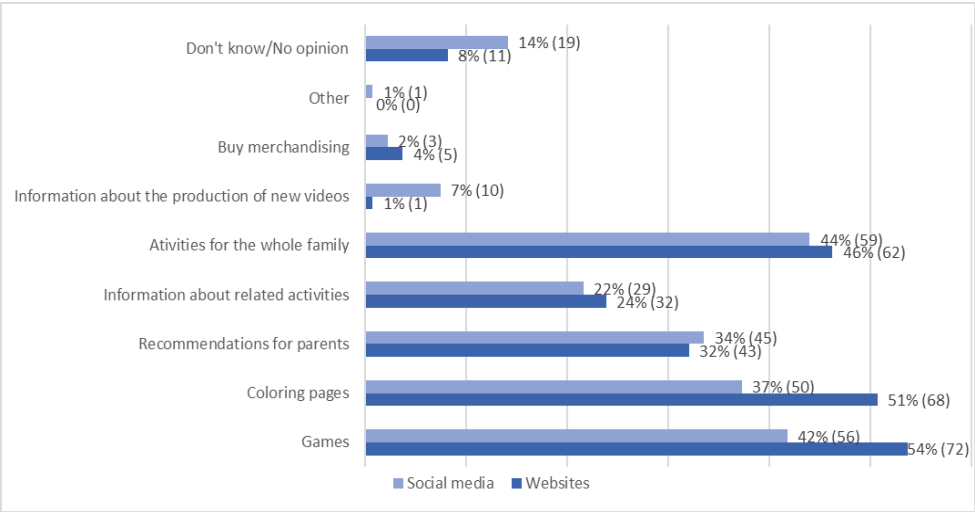


Figure 7 – Valued aspects in websites and social media profiles dedicated to educational videos for children (source: the author)

Regarding the devices that families use for consuming educational videos, the results highlight the difference between the use of the smartphone, tablet, and computer (figure 8). The smartphone is the device that families and children most use, followed by the table. The computer is hardly used, and half of the participants do not use it at all for that purpose.

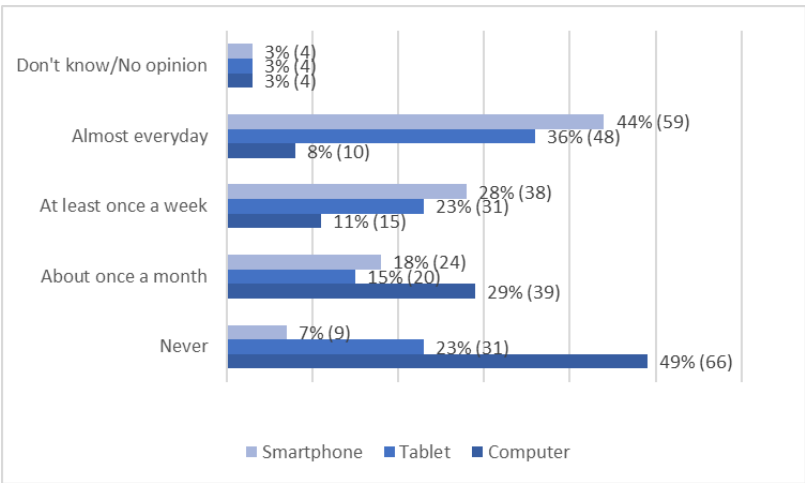


Figure 8 – Frequency of use of digital devices for consuming videos (source: the author)

Discussion and preliminary conclusions

As previously mentioned in this work, the dynamics of the consumption of audiovisual media products are changing among families worldwide, and Portuguese families are no exception. Television is no longer an isolated medium since it is now part of a multiplatform culture, in which several media and devices converge, such as television, computers, smartphones, and tablets. The concept of “screen culture” emerges in this new media landscape (Ponte, 2012) and is related to how children engage with these diverse media. In this new paradigm, traditional platforms and devices are being increasingly replaced by digital ones, a trend that has been more evident in the last few years (Lemish, 2020).

We conducted this exploratory study to investigate the dynamics of the consumption of educational videos for children on digital platforms, guided by the families.

The results demonstrate the interest of the families in consuming educational videos over content that can be inadequate for children or harmful to their development, jeopardizing their well-being. Although we did not ask if the device belonged to the children or their parents/caregivers, the possibility of sharing the device between adults and children can be risky due to the algorithms that analyze the user behavior, and families seem to disregard this risk.

The platform that families most use for consuming educational videos is YouTube, followed at a great distance by the search engine Google. These results affirm the hegemony of global commercial platforms based on advanced processes of audience capturing by algorithms.

Most families search for educational videos regularly and use the smartphone to consume them, more than the tablet, and the computer is seldom used. Thus, this shows a media environment characterized by the leadership of the smartphone and its ubiquity.

The aspects that families most value in educational videos are safety and the development of artistic skills. For searching educational videos, families mostly use

keywords related to education (in general) and artistic education. The interest in the topic of artistic education demonstrates the potential of educational videos for serving as a tool for learning outside the school context.

About two-thirds of the sample trust the recommendations of friends and relatives, which meets what the literature suggests and highlights the importance of proximal relationships. As kindergarten teachers also play an important role in recommending content, it is paramount that creators and producers consider them as their target audiences on the digital platforms they distribute their content and reach them for constituting their communities of viewers.

Regarding the dynamics of the consumption of transmedia content, more than half of the families visit websites dedicated to educational videos for children at least once a week, which suggests a relatively high interest level. The most valued content combines education, entertainment, and leisure-time activities, such as games and coloring pages. Conversely to websites, social media profiles dedicated to educational videos for children are seldom visited by the families of the sample. In this sense, the ambition of creating communities of viewers with an active curatorship of content seems to be challenging in social media.

Therefore, considering the importance of communities of viewers for promoting the visibility of videos on digital streaming platforms, the present exploratory study suggests that regarding the allocation of production resources, it may be a better option to invest in a website linked to social media, rather than in social media alone. This is because families do not perform an active search on these platforms, which causes the distribution of content to be once again dependent on the algorithms, representing one more challenge for visibility.

Preliminary conclusions

The production and distribution of educational videos for children face new challenges in these times of convergence between platforms caused by the disruption of traditional distribution models. These models are being replaced by others of

dispersed content that can be released and accessed by any agent. On digital platforms, the recommendation of content is made by algorithms that select what is most probable to be enjoyed by the viewers. This poses two challenges for creators and producers: how to make their content visible to their target audience; and how to retain the attention and interest of the viewers. Creating a community of viewers can promote the visibility of the content and minimize the dependence on the algorithm.

Regarding the production of educational content for children, this study demonstrates that families mainly value aspects related to entertainment when interacting in channels and digital platforms (transmedia interactivity). Thus, when the objective is to promote learning, it is necessary to balance the educational content with entertainment (edutainment).

In what concerns the distribution, this study confirms that when parents/caregivers search for educational videos for preschool children, regardless of their level of education, the search is done according to the hegemonic patterns of the YouTube algorithms. As such, contouring the algorithms is a challenge of David against Goliath. Thus, it is paramount to think of alternative strategies that promote the visibility of the content. Creating digital communities, combining interpersonal relationships, trust circles, and transmedia environments can be a productive way of contributing to disseminating content and surpassing the initial bias of the algorithms.

The influence of relatives and friends is very relevant in choosing what videos children should watch, demonstrating that spreading content on digital platforms depends on a good user experience.

Independent producers should grasp the opportunity of disseminating their content on social media networks, close to online sharing groups. Kindergarten teachers are also an important recommendation source for families, and investing in the dissemination close to this group can be paramount for the success of an audiovisual educational project. To build a community of viewers for educational videos for children, families and kindergarten teachers should be the priority. To better understand how to build this type of digital community, it is necessary to conduct further qualitative research in the future.

3.6. General discussion

This work aimed to identify and address the challenges digital platforms pose for creating, producing, and distributing educational videos targeted at preschool children (3-5 years old), from the perspective of an audiovisual producer. In this chapter, we present a general discussion of Part I, considering our research questions, the literature review and the results of the five studies we conducted.

We divided the sections dedicated to the research questions and the literature review into four areas: discourse, design, production, and distribution. The literature we reviewed and the studies we conducted aimed to address the research questions presented in Table 59.

TABLE 59			
Area		Research Question	Method
Discourse	RQ1	How do children learn from educational videos?	Literature review
	RQ1.1	Is learning from educational videos dependent on the use of cognitive and pedagogical strategies in their production?	Study 1
Design	RQ2	What should be the characteristics of educational videos for preschool children?	Literature review
	RQ2.1	What should be the formal features of the episodes – format (animation or live-action) and editing pace?	Literature review
	RQ2.2	How should be the characters and their sociocultural contexts?	Literature review
	RQ2.3	What language and communication strategies are adequate and engaging for preschool children?	Literature review
	RQ2.4	What good practices in music education can be transferred to video?	Literature review
	RQ3	What are the production and editing strategies that make an engaging and effective educational video for preschool children?	Literature review
Production	RQ3.1	Do engagement and the learning outcomes from educational videos vary according to the screen size of the displaying devices?	Study 2
	RQ3.2	Is the effectiveness of educational videos affected by using continuity editing?	Study 3

	RQ3.3	Are dubbed educational videos as effective as not dubbed educational videos?	Study 4
Distribution	RQ4	What are the challenges of digital platforms for distributing educational videos, and how can producers address them?	Literature review
	RQ5	What are the dynamics of Portuguese families in consuming educational videos and related transmedia content?	Study 5

Table 59 – Research questions of this work (source: the author)

Regarding the creation (discourse and design), in the literature, we identified a challenge related to the assurance of the quality of educational products. As the algorithms that recommend content do not prioritize pedagogically efficient content over what is appealing or trending (Covington, Adams & Sargin, 2016), children may be exposed to products that are not adequate for their development instead of being provided with efficient learning tools.

As the literature suggests that this issue can be solved by creating good quality products from the beginning (Fisch, 2017), we investigated how children learn from educational videos (RQ1) through a literature review to acknowledge what strategies should be applied in their creation.

The literature suggests that for preschool children to learn from videos, it is paramount to apply cognitive and pedagogical strategies such as the presentation of the educational content in a clear and sequential narrative, in which the children can recognize the scenarios from their environment and feel related to the characters, which should interact with the viewers. The language should be of adequate complexity, and viewers should easily understand the dialogues. If new vocabulary is presented, it should be illustrated. Most of all, the videos should have a well-defined curriculum (Fisch, 2017; Fisch & Truglio, 2001; Linebarger, Brey, Fenstermacher & Barr, 2017; Kirkorian & Anderson, 2008; Krcmar & Cingel, 2017).

Aware of the relevance of the participation of the families in learning from videos, as well as the importance of providing media literacy to them, we created a digital instrument named EVAT – Educational Videos Assessment Tool. Through this instrument, the families and kindergarten teachers can assess the pedagogical quality of the videos before displaying them to the children, mediating the role of the

algorithm. To validate this instrument, we conducted Study 1 to investigate the importance and weight of cognitive and pedagogical strategies in creating and producing educational videos for preschool children (RQ1.1).

We concluded that cognitive and pedagogical strategies influence learning from educational videos. Thus, producers should apply these strategies in the production of their videos. We also concluded that cognitive strategies are more important than pedagogical strategies. Therefore, producers should take this information into account. Finally, we consider that the EVAT tool is valid and can be used by families and kindergarten teachers for assessing the pedagogical quality of educational videos.

Regarding the adequate characteristics for efficient educational videos (RQ2), we reviewed the literature on four topics to address four research questions: formal features (RQ2.1), characters (RQ2.2), language and communication strategies (RQ2.3), and good education practices that can be transferred to video (RQ2.4).

In what regards to the formal features, the literature suggests that live-action is the most adequate format, with a moderate pace of action. Concerning the characters, they should be diversified to best depict the sociocultural context of the viewers and enable the acquisition of social skills that are fundamental for development. Regarding language, it should be as literal as possible since preschool children do not understand non-literal language, such as irony. The use of humor is an effective communication strategy, as long it is correctly used, given that the comprehension of humor depends on cognitive development. In what regards to good education practices that can be transferred to videos, we focused on the topic of music education. We concluded that the limitations of the video format in contingent responses are challenging for the transfer of content. Thus, producers should consider the adequacy of the topic and the limitations of the medium when designing the educational curriculum.

In the production section, we investigated the strategies for producing and editing efficient and engaging educational videos for preschool children (RQ3). There are critical aspects that should be considered when producing educational videos for learners of all ages, namely the speech pace, intelligibility, quality, media diversity, and congruence (Lange & Costley, 2020). Nevertheless, these aspects are even more

important for young children since they are still developing the cognitive and perceptual structures involved in comprehending and learning from videos (Diergarten, Möckel, Nieding & Ohler, 2017).

In the literature, we identified a challenge related to the intelligibility of the videos, which can be compromised when the audio or video sources are of low quality or inadequate for cognitive processing (Lange & Costley, 2020). This can occur when the screen size of the displaying device is too small or too large, for instance. In addition, the use of different devices can result in different engagement levels, as occurs with e-books and mobile applications (Roskos, Burstein, Shang & Gray, 2014; Noorhidawati, Ghalebardi & Hajar, 2015), and a lack of engagement can compromise the learning experience. Bearing this in mind, we conducted Study 2 to investigate if the learning outcomes from educational videos and engagement of preschool children are affected by the screen size of the displaying device (RQ3.1).

We concluded that the screen size of the devices does not influence learning from educational videos, conversely to what the literature with other types of media suggests. In addition, we concluded that the engagement is not affected as well. Nevertheless, the learning outcomes are positively influenced by the engagement, which means that producers should maximize engagement with products, which can be achieved by balancing the educational content with entertainment (edutainment).

Still regarding the intelligibility of educational videos, we identified another challenge related to the use of different shot types in editing since the discrepancy in the size of the objects when alternating closer with wider shots can be hard to comprehend for younger children, in whom the perceptual skill of size constancy is still developing (Kirbas & Smith, 2019). Furthermore, given the low capacity of their working memory, young children cannot comprehend techniques such as pans (Diergarten, Möckel, Nieding & Ohler, 2017), and they are slower than older viewers in making transitions between cuts, focusing on the center of the screen (Kirkorian & Anderson, 2017). Considering all these constraints in the use of editing techniques when producing educational videos for younger children, we conducted Study 3 to investigate if the effectiveness of educational videos is affected by using continuity editing (RQ3.2). We divided Study 3 into two sections: in Study 3.1, we investigated

how to prepare the video stimuli for Study 3.2, and in the latter, we applied the materials in our investigation.

From study 3.2, we concluded that producers can edit educational videos alternating closer and wider shots if the characters and other relevant visual information are centered on the screen. This does not jeopardize the learning experience for preschool children and can provide more visual dynamics to the videos, consequently increasing their engagement.

In addition, we identified a challenge related to congruence, which can be undermined when the audio and video sources are not synchronized (Lange & Costley, 2020). This can occur in dubbed videos, for instance, and can compromise learning from them because when the image and the audio do not match, the brain prioritizes the visual information over the auditory (McGurk effect) and the content is not comprehended (Smith, Duede, Hanrahan, David, House & Greger, 2013). The McGurk effect develops in late childhood (Hirst, Stacey, Cragg, Stacey & Allen, 2018), and adult viewers unconsciously adopt a strategy of looking at the eyes of the characters instead of their mouths to not disrupt their viewing experience (Romero-Fresco, 2020). As the literature did not present evidence for what occurs with preschool children, we conducted Study 4 to investigate if dubbed educational videos are as effective as not dubbed educational videos (RQ3.3).

We concluded that dubbed videos do not undermine learning from them regarding vocabulary learning by preschool children. Therefore, producers can use dubbing in their productions if willing to export to other markets or to reach a broader audience on digital platforms.

Regarding the distribution, we investigated the challenges of digital platforms for distributing educational videos and how producers can address them (RQ4). In the literature, we identified a challenge concerning the filtering and recommendation of the content by the algorithms, which negatively affect the visibility and discoverability of independent productions without great budget availability for marketing investment (McKelvey & Hunt, 2019). Addressing this challenge requires adopting complementary forms of distribution to reinforce the digital presence of the content (Mazzoli, 2020),

such as investing in a transmedia strategy and creating a digital community of viewers (Nikolic, 2017; McKelvey & Hunt, 2019).

To design a complementary distribution model, it is paramount to acknowledge the preferred platforms of consumption of the target audiences and the transmedia content they value the most. Thus, we conducted Study 5 to investigate the dynamics of Portuguese families in consuming educational videos and related transmedia content (RQ5).

From this exploratory study, we concluded that the device families most use for consuming educational videos is the smartphone, followed by the tablet. The computer is seldom used. This information is relevant for decision-making in audiovisual production: given that families and children tend to consume educational videos on smaller screens, the choice of the shot sizes should consider the screen size. Thus, producers should choose closer shots so that the elements on the screen can be seen on smaller screen size devices. Furthermore, since these devices enable more mobility than the computer, the length of videos should be shorter to retain the attention of the viewers.

Furthermore, we concluded that families value safety and the development of artistic skills when choosing the educational videos to consume, and usually follow the recommendation of friends and kindergarten teachers. They search for this type of content mostly on YouTube and Google and consume the videos on YouTube.

When searching for videos, families use mostly keywords related to general and artistic education. Regarding transmedia content, Portuguese families visit websites dedicated to educational videos regularly, more than social media profiles. On these websites, they value content related to entertainment and family leisure time. This suggests that producers should invest in websites linked to social media profiles, and provide games, coloring pages, and suggestions of activities for the whole family with the same theme and narrative of the educational videos.

Limitations of the studies

The studies we presented in this work were conducted with significant and diverse samples, leading to valuable insights for further research. Nonetheless, we acknowledge some limitations that should be considered when interpreting the results.

A first limitation regards the pre-tests we applied in studies 1 to 4. The application of the pre-test on language skills was necessary to ensure that the results were not influenced by extraneous variables, such as the lack of comprehension of the speech in the videos. We applied a short version of the Verbal Definition Test and the Nomination Test from the battery *ALO – Avaliação da Linguagem Oral* [Oral Language Evaluation] (Sim-Sim, 1997).

As we were not applying the complete version of this battery, we had to create a criterion of inclusion/exclusion of participants from its application, and we decided to exclude the participants who had a result inferior to the mean less the standard deviation of the sample ($\mu - \sigma$). As a consequence of this criterion, we excluded several participants from the studies, and we consider that we excluded more children than what would be necessary. Therefore, the use of this criterion should be revised in future research. Furthermore, even though this battery was built for Portuguese children from 3 years old on, it was built in 1997, which means that it can be already obsolete, given that the cultural context of the children is systematically changing and evolving. Other language assessment instruments should be considered in further research.

Regarding the pre-test on the previous knowledge of the name of musical instruments, in Study 4 we assessed the knowledge on the name of the maraca. Since several children already knew it, we had to exclude them from the study in the data analysis phase, which significantly limited our sample. Thus, in future research on the same topic of this study, unusual musical instruments should be used to assess the learning of their names through educational videos.

Another limitation of our studies regards Study 2, in which we investigated the impact of the screen size of the displaying devices on the engagement and learning

outcomes from educational videos. As the screen size of the mobile phone (6,5 inches), the tablet (10,9 inches), and the laptop (13 inches) are not significantly different, we did not find differences between them. Nonetheless, it remains unclear if devices with smaller or larger screen sizes affect the results. Thus, as previously mentioned, further research should focus on a broader screen size range to analyze if the conclusions remain the same.

Furthermore, in studies 1 to 4, we only assessed the learning outcomes concerning vocabulary acquisition at the second level of the Learning Taxonomy of Bloom (“understanding”), which means that the results presented here are valid for this context. Further research should be conducted to assess other levels of learning and knowledge acquisition.

In addition, studies 1 to 4 assessed the learning outcomes immediately after displaying the educational video. As learning entails retaining knowledge in the long-term memory for more than 48 hours (Sousa, 2017), further studies should focus on a longitudinal approach to assess learning.

Finally, even though we conducted the studies in urban and rural contexts (Lisboa, Torres Vedras, and surroundings), we did not cover the whole Portuguese territory. Thus, the results presented in this work should be replicated and validated in other territories within Portugal and abroad.

Final remarks on Part I

Part I of this work was dedicated to fundamental research on creating, producing, and distributing educational videos targeted at preschool children on digital platforms. We described the challenges these platforms pose for audiovisual producers to create, produce, and distribute efficient and appealing educational videos that compete with entertainment products on platforms such as YouTube. After identifying the challenges in the literature, we systematized how to address them and summarized the results of the investigation we conducted.

Part II presents how we applied the obtained results in creating and producing the pilot episode of an educational series targeted at Portuguese preschool children about music education.

PART II

APPLIED RESEARCH

CHAPTER 4 – LARA IN MUSICLAND: AN EDUCATIONAL PROJECT OF APPLIED RESEARCH

The second part of this work presents an educational audiovisual project of applied research named *Lara no País da Música* [*Lara in Musicland*], which derives from the research we conducted in the previously presented theoretical part. This project consists of an educational audiovisual series targeted at Portuguese preschool children (3-5 years old) and aims to teach basic music education concepts. For this work, we developed the pilot episode of this series.

The structure of this part follows the areas of the Multimodal Theory of Communication (Kress & Leeuwen, 2001), namely (i) the discourse, (ii) the design, (iii) the production, and (iv) the distribution, which are the four stages for the conception of a semiotic object, such as an audiovisual product.

We begin by presenting the background of the educational series. Then, in the first stage, the discourse, we present its concept. In the second stage, the design, we summarize how the pilot episode was conceptualized. This means that in this stage, we defined the following aspects: the format, the characters, the scenarios, the communication strategies to be used, and the educational content to be covered. In the third stage, the production, we explain how the design was materialized by articulating different semiotic modes, such as image and sound. Finally, in the fourth stage, the distribution, we describe our strategy for distributing the product on digital platforms.

As we had to conjugate the timetable of our research and the schedule of the actors of the series, we prepared three different versions of the pilot episode prior to the conclusion of the studies of Part I. The version we present here is the one that meets the results of the studies we conducted. Thus, we selected it as the final version of the pilot episode. By explaining how we created and produce it, we intend to demonstrate how the results of our research can be applied in the creation of an educational audiovisual product for preschool children.

Background of the educational series – Lara in Musicland story world

In order to introduce the educational series to the target audience, we began by releasing five video clips with original songs for children on a YouTube channel we created for this project, named *Lara no País da Música* [*Lara in Musicland*]³ (figure 9).

We composed, recorded, and produced the songs, while the videoclips were made in 3D animation format by an outsourcing company called ChillTime⁴ (figure 10).

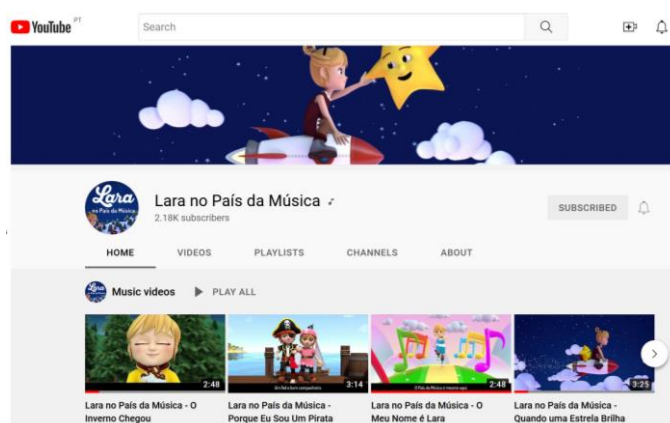


Figure 9 – Screenshot of the YouTube channel *Lara no País da Música* (source: the author)



Figure 10 – Screenshots of video clips of the songs (source: the author)

The story world of Lara is intended to be representative of the sociocultural context of the target audience. Thus, Lara, the main character, is a preschool girl who lives in Musicland along with Lisa (her sister), Leo (her best friend), Lucas (the best friend of Lisa), and Lou (their dog). Lara plays the piano, Lisa, the violin, Leo, the guitar,

³ www.youtube.com/laranopaisdamusica

⁴ <https://www.chilltime.com>

and Lucas, the drums (figure 11). Lou is a rockstar and has a song called “The rockstar dog.”



Figure 11 – Screenshot of the characters of *Lara no País da Música* [*Lara in Musicland*]: Lou, Leo, Lara, Lisa, and Lucas (from left to right) (source: the author)

In addition to the five video clips, we released a CD with a total of 12 songs, named “Canções para o Ano Inteiro” [“Songs for the whole year”] (2019). The CD was sold on FNAC (a European retail store with a consolidated position in the Portuguese market) and at other sale points. In addition, the album with all the songs was distributed on digital music streaming platforms such as Spotify and iTunes.

We organized a tour around several FNAC stores around the country, in which two musical theater actors interpreted Lara and Leo and performed several songs of the project in front of the audience (figures 12 and 13). To help children make the transition between the human and the animated versions of the characters, in the concerts, we introduced the concept of “avatar,” explaining that the animated versions of the human characters were their avatars on the Internet.

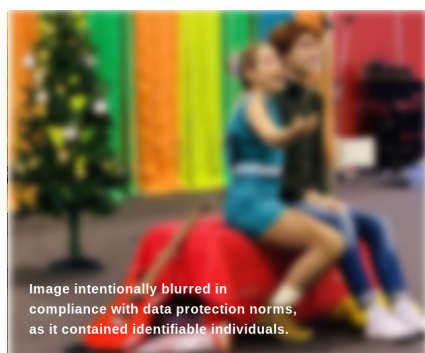


Figure 12 – Concert at Natalis – Lisbon (December 2019) (source: the author)

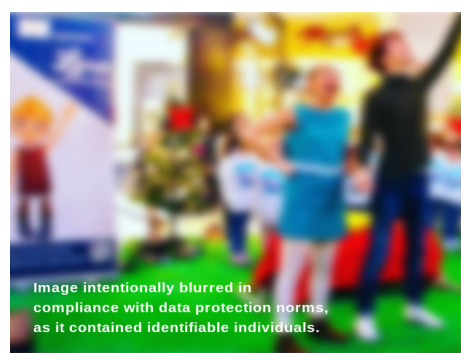


Figure 13 – Concert at Colombo Shopping Center – Lisbon (December 2019) (source: the author)

To promote the music project, we created a website⁵ in which we posted the lyrics of the songs, the hyperlinks for the videos on YouTube, the schedule of the concerts, the hyperlinks for the social profiles, and a store section for selling the CD (figure 14). Furthermore, we created a Facebook page⁶ and an Instagram profile⁷ (figures 15 and 16). These channels will be further used to host, distribute, and disseminate the educational series.



Figure 14 – Screenshot of the website of the project (source: the author)

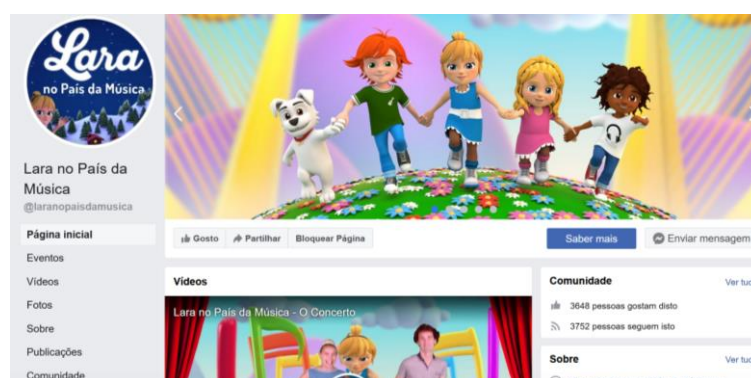


Figure 15 – Screenshot of the Facebook profile of the project (source: the author)

⁵ www.laranopaismusica.pt

⁶ www.facebook.com/laranopaismusica

⁷ www.instagram.com/laranopaismusica

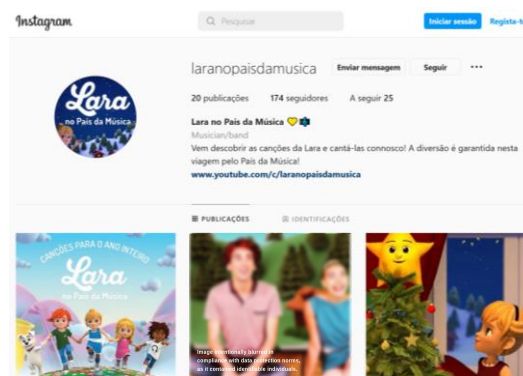


Figure 16 – Screenshot of the Instagram profile of the project (source: the author)

4.1. THE DISCOURSE

Taking the results of our investigation into consideration, we began by defining the objective of the audiovisual series, which was to convey basic music education concepts to Portuguese preschool children.

As we concluded in Study 1, children learn best from educational videos when they encompass several pedagogical and cognitive techniques in their production. Bearing this in mind, we focused on achieving the following aspects:

- A curriculum-oriented structure
- A clear and sequential narrative
- Present familiar scenarios and characters that are culturally similar to the viewers
- Use clear language, of adequate complexity for the age of the children
- Present interactivity between the characters and the viewers (parasocial interactions)
- Provide explanation and/or illustration of the meaning of new vocabulary
- Have a structure that comprises a preface to the topic, as well as a summary of the educational contents that were approached at the end of the videos.

We defined the structure of our educational series starting from this premise.

4.2. THE DESIGN

For the design of the educational series, we began by defining its educational content since this would influence the conception of the entire script.

As mentioned previously in this work, we intended to teach basic music education concepts. Therefore, we decided to cover the following educational content, starting from what was reviewed in the literature in Chapter 2, section 2.2 (“The Design”), considering the limitations of the video format and the age of our target audience:

- Properties of the sound – dynamics (loud and soft sounds), duration (long and short sounds), pitch (low and high-pitched sounds), and timbre
- Musical instruments – the guitar, the violin, the drums, and the piano.

For the pilot episode of the series, we decided that the topics to be covered would be loud and soft sounds (dynamics) and the guitar (a musical instrument)

As the literature suggests that the animation format is not adequate for educational products, we decided to adopt the live-action format for the educational series, with a moderate pace of action.

Regarding the characters and the cast, the choice of the characters for the pilot episode was made considering that the literature suggests they should be representative of the target audience. As such, we defined that the main characters of the script would be girls and boys of preschool age. In addition, the characters should be in line with the story world of *Lara in Musicland*. Thus, we decided that the four main characters, Lara, Lisa, Lucas, and Leo would participate in the episode.

As we had two educational topics to address, namely loud and soft sounds and the guitar, Lara and Leo played the part of the episode related to loud and soft sounds, while Lisa and Lucas played the part related to the guitar. Regarding the cast, Lara and Leo were performed by the same musical theater actors that made the live performances of the songs, while Lisa and Lucas were performed by two children we invited for this purpose.

In what concerns the scenarios, the literature suggests that these should be similar to those in which the children live. Thus, we decided to recreate the set of an indoor playroom. To do so, we prepared a set of furniture and toys to place in the green screen room where we captured the video. In addition, we designed digitally, in Adobe Photoshop, the walls and the floor to be placed as the background of the video. We placed screenshots of the video clips of the songs as portraits on the walls to facilitate the recognition of the characters.

Regarding the communication strategies, we used language as literal as possible since preschool children are not able to understand non-literal language such as irony. We used humor in an elementary form, mainly as pranks between Leo and Lara, given that the literature suggests that this kind of humor is appreciated among younger children.

Finally, in what regards to the structure of the episode, bearing in mind the importance of having a preface and a summary, as well as the repetition of content, in the production of educational videos for preschool children, we divided the pilot episode into five sections, namely:

- (1) The preface, in which all the educational content of the video is presented
- (2) The main part A (live-action format), in which Lara and Leo present the educational content that concerns loud and soft sounds
- (3) The reinforcement of the main part A through a song, in animation format
- (4) The main part B (live-action format), in which Lisa and Lucas interview a guitar player and present what a guitar is
- (5) The summary of loud and soft sounds by the first two characters, Lara and Leo (live-action format).

We scripted the dialogues for the main part A and the summary (the parts of Lara and Leo) (please see Attachments 9 and 10). In the main part B (Lisa and Lucas), we decided to present an interview made by Lisa and Lucas with a guitar player. The dialogues were spontaneous, as we intended to register and display the point of view and the curiosity of the children regarding the guitar.

4.3. THE PRODUCTION

To produce the live-action scenes of the pilot episode, we prepared a green screen room by painting the walls and the floor with Rosco Chroma Key Paint (5711 – green). We set five lighting spots (Jupio PowerLed 288) following the five-point lighting technique (one key light, one back light, one fill light, and two backdrop lights). For audio capture, we built double walls on the sides of the set with plasterboard of 8mm space in-between walls, filled with acoustical sponge protection and rock wool (4 mm thick each) (figures 17 and 18).



Figure 17 – Green screen room of video capture
(source: the author)



Figure 18 – Green screen room of video capture
with furniture and toys (source: the author)

Considering the results of the investigation we conducted in Part I of this work, our decision-making process in the production of the pilot episode was informed by the following premises:

- Apply a moderate level of action
- Use an adequate speech pace
- Apply cuts in editing with caution
- Use songs
- Use a theme song
- Use background music with caution

- Capture and make the treatment of audio and video in high quality for achieving intelligibility
- Use a neutral set of colors and make aesthetics choices considering the preferences of preschool children to achieve quality
- Present the educational content through different types of media to achieve media diversity
- Synchronize the different audio capture sources (microphones) in post-production to achieve congruence.

Regarding the opening of the episode, the animation segments that compose it were produced by ChillTime (animation format), being part of the videoclips of the music project to facilitate the recognition of the characters and the story world of *Lara no País da Música* [*Lara in Musicland*]. At the end of the opening, the image of live-action characters Lara and Leo appear to facilitate the transition between the animated and the live-action characters (figure 19). The theme song is the chorus of one of the songs of the music project, named “O meu nome é Lara” (“My name is Lara”).

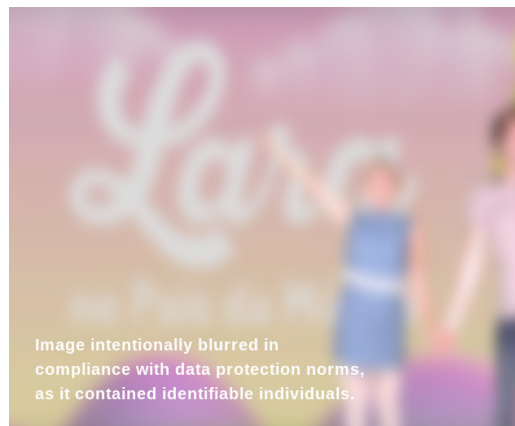


Figure 19 – Screenshot of the opening (final frame) (source: the author)

The section that follows the opening is the preface (section 1), in which we present the content of the episode. To do so, we overlayed frames with muted segments of the various sections on an animated colored background and used a voice-over to narrate the presentation of the content (figure 20).

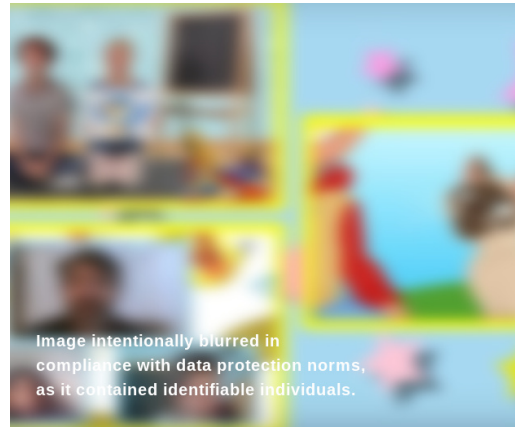


Figure 20 – Screenshot of the preface (section 1) (source: the author)

To make the transition between the sections of the episodes, we prepared five-second transition effects with animated images of the characters (avatar versions) (figure 21). As the sections are different in content and aesthetics, these elements are intended to connect them and recall the story world of *Lara no País da Música* [*Lara in Musicland*].



Figure 21 – Screenshot of a transition effect (source: the author)

In main part A (section 2 – live-action), Lara and Leo present the educational content that concerns loud and soft sounds (figure 22).

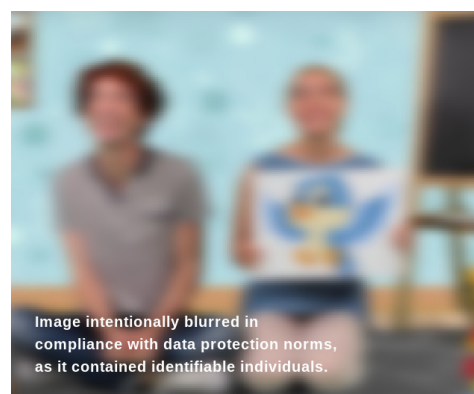


Figure 22 – Screenshot of main part A (section 2) (source: the author)

We captured the video in the green screen room we previously prepared and used the following equipment: a DSLR camera (Canon EOS 90D with Canon ES-F 18-135mm lens); two small diaphragm condenser microphones (Soundtronics STC-10); a camera tripod; two microphone stands; a multichannel audio recorder (ZOOM H4); a sound card (Steinberg UR 22); and a computer (Microsoft Surface Laptop 2) with the software Steinberg Cubase 10.

We asked the actors to speak, move, and interact at a moderate pace, to achieve a moderate level of action with adequate speech pace. Regarding the background music, we composed and recorded it in post-production on a digital workstation (Yamaha PSR-S910). As the literature suggested that we should use it with caution, we decided to use it in key moments of the video to recruit the attention of the children. Thus, we used it mainly at the beginning (the melody of the theme song, played with the sound of the marimba), at the explanation of the new vocabulary, and at the introduction of the game.

Since the video was captured continuously in full shot, we edited it in post-production using zooms to create closeups and medium closeups. Given that our investigation suggests that first-order editing is not problematic for preschool children, we decided to alternate closer with wider shots to create visual dynamics. To edit the video, we used the software Adobe Premiere.

After main part A, the following section reinforces the educational content through a song (section 3) (figure 23). The animation for this section was produced by King Bee Animation (United Kingdom). To read the lyrics of the song, please see Appendix 11.



Figure 23 – Screenshot of the reinforcement song (section 3) (source: the author)

Regarding main part B (section 4), we intended to record it in the same room as main part A. Nevertheless, given the need for social distancing during the COVID-19 pandemic, we captured audio and video through a videoconference call through the Zoom platform. In post-production, we overlaid frames with the video parts of Lisa, Lucas, and the guitar player (João) on a colored background with musical instruments (figure 24). We decided to use background music throughout the scene to retain the attention of the children.

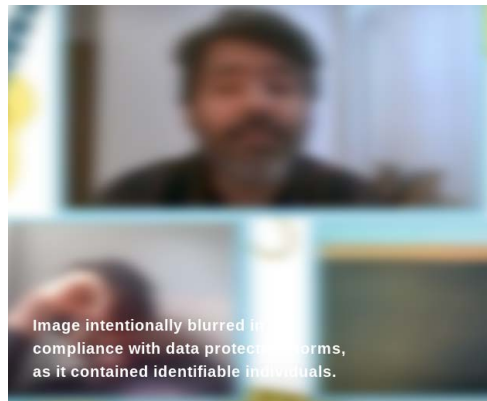


Figure 24 – Screenshot of main part B (section 4) (source: the author)

We captured the video and audio for the summary (section 5) using the same equipment and in the same room as main part A (figure 25). As we did there, we used background music only in key moments to recruit and retain the attention of the children, such as the beginning and the ending. Regarding editing in post-production, we followed the same principle of alternating closer with wider shots to create visual dynamics.

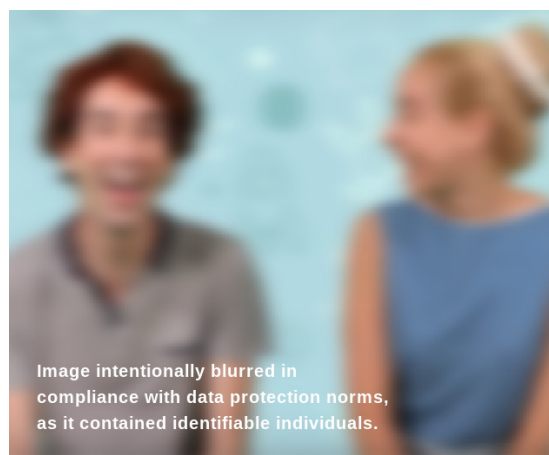


Figure 25 – Screenshot of the summary (section 5) (source: the author)

Finally, we presented the section of the credits of the episode overlaying text on an image of the animated characters of *Lara no País da Música* [*Lara in Musicland*]. The background music we used is part of the theme song (chord progression), played with the sound of pizzicato strings.

4.4. THE DISTRIBUTION

For distributing the pilot episode of the educational series we created, we hosted it on the YouTube channel dedicated to the music project *Lara no País da Música* [*Lara in Musicland*]. Given its considerable number of followers (2,18K), we consider that it already constitutes a solid ground for reaching a relevant number of viewers in the target group (link to the video: subtitled version – <https://youtu.be/ja16Zb6w7xs>; original version – <https://youtu.be/RUBsjNn8xoM>). The links will remain private until the official release of the series.

To promote the YouTube channel, we disseminated it on Facebook and Instagram prior to the release of the educational series, under the scope of the music project. Although the episodes are not available for viewing yet, by promoting the channel with the video clips we intended to increase the number of followers.

Considering the results of the investigation we conducted in Part I and aware of the importance of kindergarten teachers in recommending educational content to families, we disseminated the channel in Facebook groups dedicated to preschool education. In addition, in the description section of each video clip on YouTube, we included the links for the website of the project, the Facebook, and the Instagram profiles.

Bearing in mind the transmedia preferences of Portuguese families with preschool children, who value content related to entertainment and family leisure time, on the website we will provide coloring pages with the animated characters of the project, games, and suggestions of activities for the whole family.

CONCLUSIONS

This work aimed to identify and address the challenges digital platforms, such as YouTube, pose for audiovisual media producers regarding creating, producing and distributing educational videos for preschool children. These challenges derive from the transcoding (Manovich, 2001) processes that occur in the new landscape brought by digital media, in which the computer layer impacts the cultural layer at the level of audiovisual production. In addition, we had the objective of applying the results of the fundamental research we conducted in creating and producing the pilot episode of an educational series targeted at Portuguese preschool children. We dedicated Part I to the presentation of the fundamental research and Part II to the applied research.

In Part I of this work, we divided the research questions and the literature review into four areas: discourse, design, production, and distribution. These areas were adapted from the four stages of the conception of an audiovisual product of the Multimodal Theory of Communication (Kress & Leeuwen, 2001).

Concerning the creation of an educational video (areas of discourse and design), we identified a challenge concerning the pedagogical quality of the educational videos. Considering that the distribution model of digital platforms encompasses the recommendation of the content by algorithms, these algorithms do not necessarily select good quality content instead of what is most appealing or trending. Thus, producers should ensure the quality of their products from the beginning of their creation, and families and kindergarten teachers must be provided with media literacy to mediate the role of the algorithms.

We conducted a literature review to investigate how children learn from educational videos, aiming to understand how to achieve good quality products from the beginning (the discourse). The literature suggested that using cognitive and pedagogical strategies in the production of videos is paramount for enhancing learning. Bearing this in mind, we created a digital instrument targeted at families and kindergarten teachers (EVAT) to be used to assess the pedagogical quality of educational videos before showing them to preschool children for mediating the recommendations of the algorithms. To validate this instrument and to assess the

impact of cognitive and pedagogical strategies on Portuguese preschool children, we conducted Study 1.

This study demonstrated that using these strategies enhances learning from educational videos regarding vocabulary learning at the second level of the Learning Taxonomy of Bloom (“understanding”). Furthermore, the results suggested that cognitive strategies are more important than pedagogical ones. As this study validated the EVAT instrument, it is now available at www.evat.pt.

Regarding the design area, we investigated the appropriate characteristics of educational videos for being efficient and appealing for preschool children. We focused on the following areas: formal features (format and editing pace), characters, language and communication strategies, and good education practices that can be transferred to video in order to define the curriculum. From the literature review, we concluded that the most appropriate format is live-action; the characters and their sociocultural contexts should be diversified and representative of the environment of the children; the language should be as literal as possible; as regarding the definition of the educational curriculum, it is crucial to consider the limitations of the video format. As we focused on music education, we concluded that it is only possible to learn specific aspects of music through video, given that this field strongly depends on social interaction and contingent responses for learning to occur.

Regarding the production area, since several cognitive and perceptual structures are still developing in preschool children and these structures are fundamental for comprehending and learning from videos, the literature suggested that there are some fundamental aspects for achieving good quality educational videos: adequate speech pace, quality, intelligibility, media diversity, and congruence. In this area, we identified three challenges in the literature concerning the intelligibility and congruence of the videos.

As intelligibility refers to how the audio and video information of the videos are delivered to the viewers, we conducted Study 2 to investigate if the screen size of the displaying devices influences the learning outcomes and the engagement of preschool children. The results of this study suggest that the screen size of the devices does not

affect the learning outcomes or engagement. Notwithstanding, this study demonstrated that engagement positively affects learning from educational videos. Therefore, producers should focus on creating engaging educational content, the so-called “edutainment.”

Furthermore, in the literature, we identified another challenge related to intelligibility. The literature suggested that preschool children cannot cognitively process some editing techniques and integrate visual information from different shot sizes due to a lack of media sign literacy and cognitive development. As editing videos with different shot types is a widespread procedure in audiovisual production to create more visual and narrative dynamics, we conducted Study 3 to investigate if cuts and editing combining different shot types affect learning from educational videos.

We divided Study 3 into Study 3.1 and Study 3.2. Study 3.1 analyzed the good editing practices in educational videos from *Blue’s Clues & You* and *Sesame Street*. We identified the most used shot types and their ASL. Starting from this analysis, we created the video stimulus for Study 3.2.

In Study 3.2, we investigated if the learning outcomes from edited videos were different from those from not edited videos. This study demonstrated that edited videos alternating closer and wider shots do not affect learning when the characters and other relevant visual information are centered on the screen. Thus, producers can use different shots to create dynamic and engaging products without compromising their educational purposes.

Finally, we identified a challenge concerning congruence in dubbed educational videos, i.e., the matching between audio and video information, since dubbing entails a lack of synchronicity and is a very common translation practice on digital streaming platforms. As the literature suggested that dubbed content is hard to process cognitively for adult viewers unless they adopt a viewing strategy (the “dubbing effect”), we conducted Study 4 to understand if dubbing affected the efficiency of educational videos for preschool children. The results of this study demonstrated that dubbing does not affect learning for this target audience in general. Nevertheless, the insights we gathered suggested that to some 4- and 5-year-old children, it may begin

to represent a barrier to learning. Considering that for maximizing learning from educational videos, the videos should be cultural-representative of the viewers, it is paramount to increase the support of local productions to diversify the available content on digital streaming platforms.

Regarding the distribution area, we identified a challenge related to the visibility and discoverability of the content. This challenge emerges because the distribution model on digital streaming platforms encompasses the recommendation of the content by algorithms that select what to recommend based on statistical analyzes, which negatively affects the visibility of independent-produced content. To reach the target audiences, producers should adopt complementary or alternative distribution models such as transmedia strategies and invest in creating a community of digital viewers that share and interact with the content.

As the literature suggests that to design a transmedia strategy, it is paramount to acknowledge the digital behavior and content preferences of the target audiences, we conducted Study 5 to investigate the dynamics of consumption of educational videos by Portuguese families and their transmedia preferences.

The results of this study suggest that families mostly use the smartphone, followed by the tablet, and seldom use the computer. Therefore, producers should consider that their products will be mostly consumed on small or medium screen size devices and produce their content accordingly. Furthermore, this study demonstrated that what families value the most in educational videos are safety and the development of artistic skills. When searching for the recommendation of videos, the families rely on friends and kindergarten teachers, which make them valuable sources of information and important agents when building a digital community of viewers. When the families search for videos, they do it on Google and YouTube, using keywords related to general and artistic education, and consume them on YouTube.

Finally, regarding the use of other media, such as websites and social media, the families visit more websites than social media profiles and value content related to entertainment, such as games, coloring pages, and leisure-time activities for the whole family. Considering the results of this study, producers should adapt their productions

and allocate their resources to design a strategy for enhancing the discoverability of their products.

In Part II of this work, we applied the results of the fundamental research into the creation and production of the pilot episode of an educational series about music education named *Lara no País da Música* [*Lara in Musicland*].

Regarding the creation (discourse and design), we used cognitive and pedagogical strategies such as a curriculum-oriented structure, a clear and sequential narrative, familiar scenarios and culturally-similar characters, clear and adequate language, interactivity between the characters and the viewers, and explanation/illustration of the meaning of new vocabulary. We divided the episode into five segments, namely: preface, main part A (live-action), reinforcement of main part A (song – animation), main B (live-action), and summary.

In what concerns the production, we were guided by what the literature and the results of our studies suggest to be the best strategies for producing efficient and engaging educational videos for preschool children, which we summarize in the final remarks of this chapter.

Finally, regarding the distribution strategy, we decided to distribute the educational series on a YouTube channel dedicated to the project. To attract viewers and pave the way for the series distribution, we began by releasing child songs in animation format to introduce the viewers to the story world of *Lara no País da Música* [*Lara in Musicland*] on the same channel that will host the episodes. Besides the YouTube channel, we created a website and social media profiles. Through social media, we began to build our digital community of viewers, close to groups of kindergarten teachers and Portuguese families with preschool children.

From this work, we concluded that learning from educational videos is a demanding task for preschool children, but it represents a valuable education resource that should not be neglected. As long as researchers, creators, and producers cooperate in creating audiovisual content, it is possible to achieve efficient and engaging products that can compete with entertainment-only content on digital platforms and serve as a tool for bridging several educational gaps.

Final remarks for creators and producers of educational audiovisual content for preschool children

Creators and producers who aim to create, produce, and distribute educational videos for preschool children on YouTube should consider the following recommendations for achieving efficient and engaging content:

- Focus on what the video aims to teach (the educational curriculum) and create the script from that acknowledgment.
- Present the educational content as a story.
- Use clear language and dialogues which are easy to understand. Avoid non-literal language.
- Create scenarios that are similar to where the children live.
- Create diversified and culturally-representative characters to whom the children can relate or identify from their everyday lives.
- Use very simple humor, such as friendly pranks between the characters, exaggerating the attributes of a person or an object (e.g., a man with a very long neck), or showing impossible behavior (e.g., a whistling cow).
- Use dialogues in which the characters ask the audience direct and simple questions.
- Always explain the meaning of new words and verbs. If possible, illustrate that explanation.
- Repeat the educational content several times and diversify its presentation in different scenes and contexts.
- If possible, present the educational content through different types of media.
- Apply a moderate level of action.
- Use an adequate speech pace.

- Apply cuts in editing with caution.
- Use songs.
- Use a theme song that is easy to remember.
- Use background music with caution.
- Capture and make the treatment of audio and video in high quality.
- Make aesthetics choices considering the preferences of preschool children.
- Synchronize the different audio capture sources in post-production.
- Opt for local productions instead of dubbed content.
- Always prioritize safety and politeness.

REFERENCES

Anderson, D. R., Bryant, J., Wilder, A., Santomero, A., Williams, M., & Crawley, A. M. (2000). Researching Blue's Clues: Viewing Behavior and Impact, *Media Psychology*, 2(2), 179-194.

Anderson, D. R., & Kirkorian, H. L. (2015). Media and Cognitive Development. In R. M. Lerner (Ed.), *Handbook of Child Psychology and Developmental Science*. New Jersey: John Wiley & Sons, Inc.

Anderson, D. R., Huston, A. C., Schmitt, K. L., Linebarger, D. L., & Wright, J. C. (2001). Early childhood television viewing and adolescent behavior: The recontact study. *Monographs of the Society for Research in Child Development*, 66(1).

Anderson, L. W., Krathwohl, D.R., Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J., & Wittrock, M.C. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A revision of Bloom's Taxonomy of Educational Objectives*. New York: Pearson, Allyn & Bacon.

Angeleri, R., & Airenti, G. (2014). The Development of Joke and Irony Understanding: A Study With 3- to 6-Year-Old Children. *Canadian Journal of Experimental Psychology*, 68(2), 133-146.

Baddeley, A., & Hitch, G. (1974). Working memory. In G. Bower (Ed.), *The Psychology of Learning and Motivation*. Academic Press, 47–89.

Baddeley, A. (November 2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Science*, 4(11), 417–423.

Balanzategui, J. (2020). Towards an understanding of children's screen genres in the streaming video era: Reflecting on shifting intersections between digital media and screen studies. *European Journal of Media Studies (NECSUS)*, 9(2), 249-272.

Banasik, N. (2013). Non-literal speech comprehension in preschool children – an example from a study on verbal irony. *Psychology of Language and Communication*, 17(3), 309-323.

Bandura, A. (1965). Influence of models' reinforcement contingencies on the acquisition of imitative responses. *Journal of Personality and Social Psychology*, 1(6), 589-959.

Bandura, A. (2009). Social cognitive theory of mass communications. In J. Bryant & M. B. Oliver (Eds.), *Media Effects: Advances in theory and research*. Mahwah, New Jersey: Lawrence Erlbaum, 94-124 [2nd edition].

Bariaud, F. (2013). Age Differences in Children's Humor. In P. E. McGhee (Ed.), *Humor and Children's Development: A Guide to Practical Applications*. London/New York: Routledge. [1989]

Barr, R. (2010). Transfer of learning between 2D and 3D sources during infancy: Informing theory and practice. *Developmental Review*, 30, 128-154.

Barr, R., Lauricella, A., Zack, E., & Calvert, S. L. (2010). Infant and early childhood exposure to adult-directed and child-directed television programming relations with cognitive skills at age four. *Merrill-Palmer Quarterly*, 56, 21-48.

Barr, R., Shuck, L., Salerno, K., Atkinson, E. & Linebarger, D. L. (2010). Music Interferes with Learning from Television during Infancy. *Infant and Child Development*, 19, 313-331.

Basílio, A. (2018). Na hora de programar: como o ZIG ZAG mantém o seu espírito na onda de convergência. In C. Ponte & C. Martins (Eds.), *BOOM DIGITAL? Crianças (3-8 anos) e ecrãs*. Lisbon: ERC – Entidade Reguladora para a Comunicação Social.

Bell, A. (1984). Language Style as Audience Design. *Language in Society*, 13, 145-204.

Berkowitz, A. L. (2010). *The Improvising Mind: Cognition and Creativity in the Musical Moment*. Oxford: Oxford University Press.

Bernardo, N. (2011). *The producer's guide to transmedia: How to develop, fund, produce and distribute compelling stories across multiple platforms*. Lisbon: BeActive Books.

Bernardo, N. (2014). *Transmedia 2.0: How to create an entertainment brand using a transmedial approach to storytelling*. Lisbon: BeActive Books.

Blakemore, S. J. & Frith, U. (2009). *O Cérebro que Aprende*. Lisbon: Gradiva.

Bloom, B.S. Engelhart, M.D., Furst, E.J., Hill, W.H., & Krathwohl, D.R. (1956). In B. S. Bloom (Ed.), *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain*. New York: David McKay Co., Inc.

Bluestine, E. (2000). *The ways children learn music: An introduction and practical guide to music learning theory*. Chicago: GIA Publications.

Blumberg, F. C., Brooks, P. J., Powers, K. L. & Marcial, C. (2017). Media Use as a Context for Cognitive Development: What is and Should be Known?. In F. C. Blumberg & P. J. Brooks (Eds.), *Cognitive Development in Digital Contexts*. Academic Press.

Bond, B. J., & Calvert, S. L. (2014). A model and measure of US parent's perceptions of young children's parasocial relationships. *Journal of Children and Media*, 8, 286-304.

Brunick, K. L., Putnam, M. M., McGarry, L. E., Richards, M. N., & Calvert, S. L. (2016). Children's future parasocial relationships with media characters: the age of intelligent characters. *Journal of Children and Media*, 10 (2), 181-190.

Bryant, J., & Zillmann, D. (2013). Using Humor to Promote Learning in the Classroom. In P. E. McGhee (Ed.). *Humor and Children's Development: A Guide to Practical Applications*. London/New York: Routledge. [1989]

Calvert, S. L. (2017). Parasocial Relationships with Media Characters: Imaginary Companions for Young Children's Social and Cognitive Development. In F. C. Blumberg & P. J. Brooks (Eds.) *Cognitive Development in Digital Contexts*. Cambridge: Academic Press, 93-117.

Calvert, S. L., Putnam, M. M., Aguiar, N. R., Ryan, R. M., Wright, C. A., Liu, Y. H. A., & Barba, E. (2019). Young Children's Mathematical Learning from Intelligent Characters. *Child Development*, 91 (5), 1491-1508.

Caspurro, H. (2007). O contributo epistemológico de Edwin Gordon para a história da pedagogia da escuta. *Revista da APEM (Associação Portuguesa de Educação Musical)*, 127, 16-27.

Castro Caldas, A. (2012), *Viagem ao Cérebro e a algumas das suas competências*. Lisbon: Universidade Católica Editora. [2008]

Castro-Caldas, A. (2017). *Criatividade: a função cerebral improvável*. Lisbon: Universidade Católica Editora.

Chaume, F. (2013). *Audiovisual translation: Dubbing*. Manchester: St. Jerome.

Christakis, D. A., Zimmerman, F. J., DiGuseppe, D. L., & MacCarty, C. A. (2004). Early television exposure and subsequent attentional problems in children. *Pediatrics*, 113, 708-713.

Clark, H. (1996). *Uses of Language*. Cambridge: Cambridge University Press.

Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3(3), 149–210.

Collins, H. (2010). *Tacit and explicit knowledge*. Chicago/London: The University of Chicago Press, Kindle Edition

Comstock, G., & Scharrer, E. (2012). The Use of Television and Other Screen Media. In D. G. Singer, & J. L. Singer (Eds.). *Handbook of children and the media*. Los Angeles: Sage.

Courage, M. L. (2017). Screen Media and the Youngest Viewers: Implications for Attention and Learning. In F. C. Blumberg & P. J. Brooks (Eds). *Cognitive Development in Digital Contexts*. Cambridge: Academic Press, 3-28.

Covington, P., Adams, J., & Sargin, E. (2016). Deep Neural Networks for YouTube Recommendations. *Proceedings of the 10th ACM Conference on Recommender Systems*, 191-198.

Crawley, A. M., Anderson, D. R., Santomero, A., Wilder, A. Williams, M., Evans, M. K., & Bryant, J. (2002). Do Children Learn How to Watch Television? The Impact of Extensive Experience With Blue's Clues on Preschool Children's Television Viewing Behavior. *Journal of Communication*, 52(2), 264-280.

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program Blue's Clues on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology*, 91, 630-637.

Creating for YouTube Kids: A Field Guideline. Retrieved from <https://www.youtube.com/yt/family/>.

Danielson, K., Wong, K. M., & Neuman, S. B. (2019). Vocabulary in educational media for preschoolers: a content analysis of word selection and screen-based pedagogical supports. *Journal of Children and Media*, 13 (3), 345-362.

Dena, C. (2009). Transmedia practice: Theorising the practice of expression a fictional world across distinct media and environments [Ph.D. dissertation, University of Sydney, Australia].

Dias, P., & Brito, R. (2018). *hAPPy KIDS: Aplicações seguras e benéficas para crianças felizes – perspectiva dos pais*. Lisbon: Centro de Estudos de Comunicação e Cultura – Universidade Católica Portuguesa.

Diergarten, A. K., Möckel, T., Nieding, G., & Ohler, P. (2017). The impact of media literacy on children's learning from films and hypermedia. *Journal of Applied Developmental Psychology* 48, 33-41.

Duchesne, S., & McMaugh, A. (2016). *Educational Psychology for Learning and Teaching*. Victoria/North Shore: Cengage Learning Australia.

Emmott, C., & Alexander, M. (2014). Schemata. In P. Hühn, J. Pier, W. Schmid, & J. Schönert (Eds.). *Handbook of Narratology*. Berlin/New York: Walter de Gruyter, 411-419.

Falk, J. H., & Dierking, L. D. (2000). *Learning From Museums: Visitor Experiences and the Making of Meaning*. Lanham/Plymouth: AltaMira Press, Kindle Edition.

Farmer-Dougan, V., & Alferink, L. A. (2013). Brain Development, Early Childhood, and Brain-Based Education: A Critical Analysis. In L. H. Wasserman & D. Zamboo (Eds.), *Early Childhood and Neuroscience – Links to Development and Learning*. London/New York: Springer.

Filippova, E. (2014). Irony production and comprehension. In D. Matthews (Ed.), *Pragmatic Development in First Language Acquisition*. Amsterdam/Philadelphia: John Benjamins.

Fisch, S. M., & Truglio, R. T. (2001). Why Children Learn From Sesame Street. In S. M. Fisch & R. T. Truglio (Eds.), *"G" is for growing: Thirty years of research on children and Sesame Street*. London/New York: Routledge.

Fisch, S. M. (2004). *Children's Learning from Education Television: Sesame Street and Beyond*. London/New York: Routledge.

Fisch, S. M. (2013a). Cross-platform learning: on the nature of children's learning from multiple media platforms. In F. C. Blumberg & S. M. Fisch (Eds.), *Digital Games: A Context for Cognitive Development*. New Directions for Child and Adolescent Development 139, 59-70.

Fisch, S. M. (2013b). Learning from Educational Television. In D. Lemish (Ed.), *The Routledge International Handbook of Children, Adolescents and Media*. London/New York: Routledge.

Fisch, S. M. (2017). Bridging Theory, & Practice: Applying Cognitive and Educational Theory to the Design of Educational Media. In F. Blumberg & P. J. Brooks (Eds.), *Cognitive Development in Digital Contexts*. Academic Press, Kindle Edition.

Fisch, S. M., Damashek, S., & Aladé, F. (2016). Designing media for cross-platform learning: developing models for production and instructional design. *Journal of Children and Media*, 10(2), 238-247.

Flynn, R. M., Wong, K. M., Neuman, S. B., & Kaefer, T. (2019). Children's attention to screen-based pedagogical supports: an eye-tracking study with low-income preschool children in the United States. *Journal of Children and Media*, 13(2), 180-200.

Foster, E. M., & Watkins, S. (2010). The value of reanalysis: TV viewing and attention problems. *Child Development*, 81, 368–375.

Gerbner, G., Gross, L., Morgan, M., Signorielli, N., & Shanahan, J. (2002). Growing up with television: Cultivation processes. In J. Bryant & D. Zillman (Eds.),

Media effects: Advances in theory and research. Hillsdale: Lawrence Erlbaum, 43-67 [2nd Edition].

Germeys, F., & d'Ydewalle, G. (2007). The psychology of film: perceiving beyond the cut. *Psychological Research*, 71, 458-466.

Goodrich, S., Pempek, T., & Calvert, S. L. (2009). Formal production features of infant and toddler DVDs. *Archives of Pediatrics and Adolescent Medicine*, 163(12), 1151-1156.

Gordon, E. (2000). *Teoria de aprendizagem musical: competências, conteúdos e padrões*. Lisbon: Fundação Calouste Gulbenkian.

Grice, H. P. (1989). *Studies in the Way of Words*. Cambridge, MA: Harvard University Press.

Grieshaber, S., & Yelland, N. (1998). Blurring the edges. In N. Yelland (Ed.), *Gender in early childhood*. London/New York: Routledge, Kindle Edition.

Halim, M. L., & Ruble, D. (2010). Gender Identity and Stereotyping in Early and Middle Childhood. In J. Chrisler & D. McCreary (Eds.), *Handbook of Gender Research in Psychology*. New York: Springer, 495-525.

Hanenberg, P. (2014). Cultura e Cognição: Como o estudo da cultura pode contribuir para as ciências cognitivas. In A. Castro-Caldas e P. Hanenberg (Eds.), *Povos e Culturas*, 18. Lisbon: CEPCEP – Universidade Católica Portuguesa, 25-38.

Hanenberg, P. (2009), "Culture and Cognition – or The Power of Tacit Knowledge", *1st Workshop at the Calouste Gulbenkian Foundation on Next Future*

Hanenberg, P. (2011). "'My Favorite Things'. The proximal term of tacit knowledge". In M. Franco e B. Sieberg (Eds.), *Proximidade e Distância. Estudos sobre a Língua e a Cultura*. Lisbon: Universidade Católica Editora.

Hardiman, M. M. (2012), *The brain-targeted teaching model for 21st-century schools*. London/New Delhi/Singapore/Thousand Oaks: Corwin, SAGE, Kindle Edition

Harris, M., & Pexman, P. M. (2003). Children's Perceptions of the Social Functions of Verbal Irony. *Discourse Processes*, 36(3), 147-165.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. New York: Routledge.

Hensch, T. K. (2005). Critical period plasticity in local cortical circuits. *Nature Reviews Neuroscience*, 6, 877–888.

Hill, A., Steemers, J., Roscoe, J., Donovan, J., & Wood, D. (2017). Media Industries and Engagement: A Dialogue across Industry and Academia. *Media Industries*, 4 (1).

Hirst, R. J., Stacey, J. E., Cragg, L., Stacey, P. C., & Allen, H. A. (2018). The threshold for the McGurk effect in audio-visual noise decreases with development. *Scientific Reports*, 8 (1).

Hogan, P. C. (2003). *A Guide for Humanists to Cognitive Science, Literature and the Arts*. London/New York: Routledge, Kindle Edition

Hoicka, E. (2014). The pragmatic development of humor. In D. Matthews (Ed.), *Pragmatic Development in First Language Acquisition*. Amsterdam/Philadelphia: John Benjamins.

Huber, B., Yeates, M., Meyer, D., Fleckhammer, L., & Kaufman, J. (2018). The effects of screen media content on young children's executive functioning. *Journal of Experimental Child Psychology*, 170, 72-85.

Hunter, M. (2004). *Mastery teaching*. Thousand Oaks: Corwin.

Huston, A. C., & Wright, J. C. (1989). *The Forms of Television and the Child Viewer, Vol. 2*. New York: Academic Press.

Huston, A. C., Anderson, D. R., Wright, J. C., Linebarger, D. L., & Schmitt, K. L. (2001). Sesame Street Viewers as Adolescents: The Recontact Study. In S. M. Fisch & R. T. Truglio (Eds.), *"G" is for growing: Thirty years of research on children and Sesame Street*. London/New York: Routledge.

Hutton, J.S., Dudley, J., Horowitz-Kraus, T., DeWitt, T., & Holland, S.K. (2020). Differences in Functional Brain Network Connectivity During Stories Presented in Audio, Illustrated, and Animated Format in Preschool-Age Children. *Brain Imaging and Behavior*, 14(2).

Immordino-Yang, M. H., & Fischer, K. W. (2010). Neuroscience Bases of Learning. In P. Peterson, E. Baker & B. McGaw, B. (Eds.), *International Encyclopedia of Education (3rd Edition)*, 310-316. Oxford: Elsevier.

Immordino-Yang, M. H., & Faeth, M. (2010). The Role of Emotion and Skilled Intuition in Learning. In D. A. Sousa (Ed.), *Mind, brain and education: neuroscience implications for the classroom*. Bloomington: Solution Tree Press, Kindle Edition

Jenkins, H. (2006). *Convergence Culture: Where Old and New Media Collide*. New York: New York University Press.

Jenkins, H., Ford, S., & Green, J. (2013). *Spreadable Media: Creating Value and Meaning in a Networked Culture*. New York/London: NYU Press.

Jordan, A.B., & Woodward, E. (1997). *The 1997 State of Children's Television Report: Programming for Children over Broadcast and Cable Television (Rep. No. 14)*. The Annenberg Public Policy Center of the University of Pennsylvania: Philadelphia.

Kim, D., & Kim, D. J. (2012). Effects of screen size on multimedia vocabulary learning. *British Journal of Educational Technology*, 43(1), 62-70.

Kirbas, S. I., & Smith, T. J. (2019). How Infants Perceive Animated Films. In M. Uhrig (Ed.), *Emotion in Animated Films*. New York: Routledge.

Kirkorian, H. L., & Anderson, D. R. (2008). Learning from Educational Media. In S. L. Calvert & B. J. Wilson (Eds.), *The handbook of children, media and development*. Chichester: Wiley-Blackwell, Kindle Edition.

Kirkorian, H. L., & Anderson, D. R. (2017). Anticipatory Eye Movements While Watching Continuous Action Across Shots in Video Sequences: A Developmental Study. *Child Development*, 88(4), 1284-1301.

Kirkorian, H. L., Lavigne, H. J., Hanson, K. G., Troseth, G.L., Demers, L. B., & Anderson, D. R. (2016). Video deficit in toddlers object retrieval: What eye movements reveal about online cognition. *Infancy*, 21, 37-64.

Koolstra, C. M., Peeters, A. L., & Spinhof, H. (2002). The Pros and Cons of Dubbing and Subtitling. *European Journal of Communication*, 17(3), 325-354.

Koolstra, C. M., Zanten, J., Lucassen, N., & Ishaak, N. (2004). The formal pace of Sesame Street over 26 years. *Perceptual and Motor Skills*, 99, 345-460.

Kostyrka-Allchorne, K., Cooper, N. R., Gossmann, A. M., Barber, K. J., & Simpson, A. (2017) Differential effects of film on preschool children's behaviour dependent on editing pace. *Acta Paediatrica*, 106(5), 831-836.

Kostyrka-Allchorne, K., Cooper, N. R., & Simpson, A. (2017). The relationship between television exposure and children's cognition and behaviour: A systematic review. *Developmental Review*, 44, 19-58.

Kostyrka-Allchorne, K., Cooper, N. R., & Simpson, A. (2019). Disentangling the effects of video pace and story realism on children's attention and response inhibition. *Cognitive Development*, 49, 94-104.

Kostyrka-Allchorne, K., Cooper, N. R., Kennett, S., Nestler, S., & Simpson, A. (2019). The Short-Term Effect of Video Editing Pace on Children's Inhibition and N2 and P3 ERP Components during Visual Go/No-Go Task. *Developmental Neuropsychology*, 44(4), 385-396.

Koumi, J. (2013). Pedagogic design guidelines for multimedia materials: a call for collaboration between practitioners and researcher. *Journal of Visual Literacy*, 32(2), 85-114.

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook II: Affective Domain*. New York: David McKay Co., Inc.

Krcmar, M., & Cingel, D. P. (2017). Do Young Children Really Learn Best From the use of Direct Address in Children's Television? *Media Psychology*, 22, 152-171.

Krcmar, M., Grela, B., & Lin, K. (2007). Can toddlers learn language from television? An experimental approach. *Media Psychology*, 10, 41-63.

Küntay, A. C. (2012). Crosslinguistic research. In E. Hoff (Ed.), *Research Methods in Child Language: A Practical Guide*. Hoboken, New Jersey: Wiley-Blackwell, 285-299.

Lange, C., & Costley, J. (2020). Improving online video lectures: learning challenges created by media. *International Journal of Educational Technology in Higher Education*, 17, article no. 16.

Leitão, E. S. (2008). *Desenhos Animados. Discursos sobre o Ser Criança*. Lisbon: Edições 70.

Lemish, D. (2020). Children and Television: A Special Audience for a Special Medium. In J. Wasko & E. R. Meehan (Eds.), *A Companion to Television*. New Jersey: John Wiley & Sons, Inc. [2nd edition].

Liebers, N., & Schramm, H. (2019). Parasocial Interactions and Relationships with Media Characters – An Inventory of 60 Years of Research. *Communication Research Trends*, 38(2), 4-31.

Lillard, A. S., & Peterson, J. (2011). The Immediate Impact of Different Types of Television on Young Children's Executive Function. *Pediatrics*, 128 (4), 644-649.

Lillard, A. S., & Peterson, J. (2011). The immediate impact of different types of television on young children's executive function. *Pediatrics*, 128, 644-649.

Lillard, A. S., Drell, M. B., Richey, E. M., Boguszewski, K., & Smith, E. D. (2015). Further examination of the immediate impact of television on children's executive function. *Developmental Psychology*, 31, 362-369.

Linebarger, D. L. (2015). Educational Media: Potentials for Learning. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences (2nd Edition, Vol. 7)*. Oxford: Elsevier, 246-254.

Linebarger, D. L., & Piotrowski, J. T. (2010). Structure and strategies in children's educational television: The roles of program type and learning strategies in children's learning. *Child Development*, 81(5), 1582-1597.

Linebarger, D. L., Brey, E., Fenstermacher, S., & Barr, R. (2017). What Makes Preschool Educational Television Educational? A Content Analysis of Literacy, Language-Promoting, and Prosocial Preschool Programming. In R. Barr & D. N. Linebarger (Eds.), *Media Exposure During Infancy and Early Childhood: The Effects of Content and Context on Learning and Development*. Cham: Springer, 97-133.

Loukusa, S., & Leinonen, E. (2008). Development of comprehension of ironic utterances in 3- to 9-year-old Finnish-speaking children. *Psychology of Language and Communication*, 12(1), 55-69.

Lozano, J. R. (2017). Bringing all the Senses into Play: The Dubbing of Animated Films for Children. *Palimpsestes*, 30, 100-115.

Lozano-Blasco, R., Quilez-Robres, A., Delgado-Bujedo, D., & Latorre-Martínez, M. P. (2021). YouTube's growth in use among children 0-5 during COVID19: The Occidental European case. *Technology in Society*, 66, 101648.

Manovich, L. (2001). *The Language of New Media*. Cambridge, MA: MIT Press.

Mares, M. L., & Kretz, V. (2015). Media Effects on Children. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences (2nd Edition, Vol. 15)*. Oxford: Elsevier, 35-41.

Mayer, R. E., & Fiorella, L. (2014). Principles for reducing extraneous processing in multimedia learning: Coherence, signaling, redundancy, spatial contiguity, and temporal contiguity principles. In R. E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning*. Cambridge: Cambridge University Press.

Mayer, R. E. (2014a). Cognitive theory of multimedia learning. In R. E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning*. Cambridge: Cambridge University Press.

Mayer, R. E. (2014b). Multimedia instruction. In J. M. Spector, M. D. Merrill, J. Elen & M. J. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology*. New York: Springer, 385-399.

Mazzoli, E. M. (2020). Online content governance: Towards a framework for analysis for prominence and discoverability. *Journal of Digital Media & Policy*, 11(3), 301-319.

McGhee, P. E. (1979). *Humor: Its origin and development*. San Francisco: Freeman.

McGhee, P. E. (2002). *Understanding and promoting the development of children's humor: A guide for parents and teachers*. Dubuque, Iowa: Kendall/Hunt Pub.

McKelvey, F., & Hunt, R. (2019). Discoverability: Toward a Definition of Content Discovery Through Platforms. *Social Media + Society*, 5(1), 1-15.

Messenger-Davies, M. (2011). *Children, media and culture*. Maidenhead: Open University Press.

Moody, A. K., Justice, L. M., & Cabell, S. Q. (2010). Electronic versus traditional storybooks: Relative influence on preschool children's engagement and communication. *Journal of Early Childhood Literacy*, 10(3), 294-313.

Mori, M., MacDorman, K. F., & Kageki, N. (2012). The uncanny valley [from the field]. *IEEE Robotics & Automation Magazine*, 19, 98-100.

Munk, C., Diergarten, A. K., Nieding, G., Ohler, P., & Schneider, W. (2012). Die kognitive Entwicklung des Verständnisses filmischer Montagetechniken bei Kindern als ein Kernbereich der Medienkompetenz [The cognitive development of the understanding in children of montage techniques in film as a core segment for media competence]. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, 44(2), 81–91.

Munk, C., Rey, G. D., Diergarten, A. K., Nieding, G., Schneider, W., & Ohler, P. (2012). Cognitive Processing of Film Cuts Among 4- to 8-Year-Old Children. *European Psychologist*, 17(4), 257-265.

Mursell, J. L. (1958). Growth process in music education. In N. B. Henry (Ed.), *Basic concepts in music education*. Chicago: The National Society for the Study of Education, 140-162.

Neuman, S. B. (2005). Television as a learning environment: A theory of synergy. In J. Flood, S. B. Heath, & D. Lapp (Eds.), *Handbook of Research on Teaching Literacy through the Communicative and Visual Arts*. New Jersey: Lawrence Erlbaum Associates, Inc. [1997]

Neumann, M. M., & Herodotou, C. (2020). Evaluating YouTube videos for young children. *Education and Information Technologies*, 25, 4459-4475.

Newton, P. M., Da Silva, A., & Peters, L. G. (2020). A Pragmatic Master List of Action Verbs for Bloom's Taxonomy. *Frontiers in Education*, 5, article no. 107.

Nikolic, V. (2017). *Independent filmmaking and digital convergence: Transmedia and beyond*. New York: Routledge.

Noorhidawati, A., Ghalebardi, S. G., & S. Hajar, R. (2015). How Do Young Children Engage with Mobile Apps? Cognitive, Psychomotor, and Affective Perspective. *Computers & Education*, 87, 385-395.

O'Brien, H. L., & Toms, E. G. (2008). What is User Engagement? A Conceptual Framework for Defining User Engagement with Technology, *Journal of the American Society for Information Science and Technology*, 59(6), 938-955.

O'Doherty, K., Troseth, G. L., Shimpi, P. M., Goldenberg, E., Ahktar, N., & Saylor, M. M. (2011). Third-party social interaction and word learning from video. *Child Development*, 82(3), 902–915.

Palmer, E. L., & Fisch, S. M. (2001), The Beginnings of Sesame Street Research. In S. M. Fisch & R. T. Truglio (Eds.), *"G" is for growing: Thirty years of research on children and Sesame Street*. London/New York: Routledge.

Palmer, S. (2000). Working memory: A developmental study of phonological recoding. *Memory*, 8, 179-193.

Parkes, A., Sweeting, H., Wight, D., & Henderson, M. (2013). Do television and electronic games predict children's psychosocial adjustment? Longitudinal research using the UK Millennium Cohort Study. *Archives of Disease in Childhood*, 98, 341–348.

Parry, B. (2013). *Children, Film and Literacy*. Nova Iorque: Palgrave Macmillan.

Pereira, S. (2007). *Por Detrás do Ecrã: televisão para crianças em Portugal*. Oporto: Porto Editora.

Perner, J. (1993). *Understanding the representational mind*. Cambridge, MA: MIT Press.

Pexman, P. M., & Glenwright, M. (2007). How do typically developing children grasp the meaning of verbal irony? *Journal of Neurolinguistics*, 20, 178 – 196.

Pexman, P. M., Glenwright, M., Krol, A., & James, T. (2005). An Acquired Taste: Children's Perceptions of Humor and Teasing in Verbal Irony. *Discourse Processes*, 40(3), 259-288.

Pi, Z., Hong, J., & Yangt, J. (2017). Does instructor's image size in video lectures affect learning outcomes? *Journal of Computer Assisted Learning*, 33(4), 347-354.

Piaget, J. (1936). *Origins of intelligence in the child*. London: Routledge & Kegan Paul.

Piaget, J. (1971). *Science of education and the psychology of the child*. New York: Orion Press.

Pietschmann, D., Völkel, S., & Ohler, P. (2014). Limitations of transmedia storytelling for children: a cognitive developmental analysis. *International Journal of Communication*, 8, 2259-2282.

Pittorf, M. L., Lehmann, W., & Huckauf, A. (2014). The Understanding of Pans in 3- to 6-Year-Old Children. *Media Psychology*, 17(3), 332-355.

Ponte, C. (1998). *Televisão para Crianças: o direito à diferença*. Lisbon: Escola Superior de Educação João de Deus.

Ponte, C. (2012). *Crianças & media: pesquisa internacional e contexto português do século XIX à atualidade*. Lisbon: Imprensa de Ciências Sociais.

Ponte, C., Simões, J., Batista, S., Castro, T., & Jorge, A. (2017). *Crescendo entre ecrãs – uso de meios eletrónicos por crianças (3-8 anos)*. Lisbon: ERC – Entidade Reguladora para a Comunicação Social.

POSCON (2014). POSCON, Positive Online Content and Services for Children in Europe. European Union. Retrieved from www.positivecontent.eu/app/download/5794080994/POSCON_FINAL_Report.pdf.

Posner, R. (2004). Basic Tasks of Cultural Semiotics. In G. Withalm, & J. Wallmannsberger (Eds.), *Signs of Power – Power of Signs: Essays in Honor of Jeff Bernard*. Vienna: INST., 56-89.

Postman, N. (1992). *Technopoly: The Surrender of Culture to Technology*. New York: Knopf.

Postman, N. (1994). *The Disappearance of Childhood*. New York: Vintage Books.

Potter, A., & Steemers, J. (2017). *Children's television in transition: policies, platforms and production*. Media International Australia, 163, 1, 6-12.

Potter, A., & Steemers, J. (2020). Transforming markets for children's television industries. In S. Shimpach (Ed.), *The Routledge Companion to Global Television*. New York: Routledge.

Potter, W. J. (2013). *Media literacy*. Thousand Oaks, CA: SAGE Publications. [6th edition].

Pratt, J., Radulescu, P. V., Guo, R. M., & Abrams, R. A. (2010). It's alive! Animate motion captures visual attention. *Psychological Science*, 21, 1724–1730.

Rasmussen, E. E., Strouse, G. A., Colwell, M. J., Johnson, C. R., Holiday, S. Brady, K., Flores, I., Troseth, G., Wright, H. D., Densley, R. L., & Norman, M. S. (2018). Promoting preschoolers' emotional competence through prosocial TV and mobile app use. *Media Psychology*, 22(1), 1-22.

Rasool, A. (2020). Report: YTK is the Most Used Streaming App, Even more than YouTube. Digital Information World. Retrieved from <https://www.digitalinformationworld.com/2020/04/top-video-streaming-apps-by-time-spend-in-2020-globally.html>.

Rato, J., & Castro-Caldas, A. (2017). *Quando o Cérebro do Seu Filho Vai à Escola*. Lisbon: Verso de Kapa.

Reese, E., Sparks, A., & Leyva, D. (2010). A review of parent interventions for preschool children's language and emergent literacy. *Journal of Early Childhood Literacy*, 10, 97-117.

Reeves, B., Lang, A. Kim, E. Y., & Tatar, D. (1999). The effects of screen size and message content on attention and arousal. *Media Psychology*, 1, 49-68.

Ribes, X. (2020). Is the YouTube Animation Algorithm-Friendly? How YouTube's Algorithm Influences the Evolution of Animation Production on the Internet. *Animation: an interdisciplinary journal*, 15(3), 229- 245.

Rice, M. L. (1984). The words of children's television. *Journal of Broadcasting & Electronic Media*, 28(4), 445-461.

Richards, M. N., & Calvert, S. L. (2017). Media Characters, Parasocial Relationships, and the Social Aspects of Children's Learning Across Media Platforms. In R. Barr, & D. N. Linebarger (Eds.), *Media Exposure During Infancy and Early Childhood: The Effects of Content and Context on Learning and Development*. Cham: Springer, 141-164.

Richert, E. A., Shawber, A. B., Hoffman, R. E., & Taylor, M. (2009). Learning from Fantasy and Real Characters in Preschool and Kindergarten. *Journal of Cognition and Development*, 10(1-2), 41-66.

Richert, R. A., Robb, M. B., & Smith, E. I. (2011). Media as Social Partners: The Social Nature of Young Children's Learning from Screen Media. *Child Development*, 82(1), 82-95.

Rideout, V., & Robb, M. B. (2020). *The Common Sense Census: Media use by kids age zero to eight*. San Francisco, CA: Common Sense Media.

Rieder, B. Matamoros-Fernández, A., & Coromina, Ò. (2018). From ranking algorithms to 'ranking cultures': Investigating the modulation of visibility in YouTube search results. *Convergence: The International Journal of Research into New Media Technologies*, 24(1), 50-68.

Rodrigues, H., Rodrigues, P. F., & Rodrigues, P. M. (2016). Colos de Música. In H. Rodrigues, P. F. Rodrigues, & P. M. Rodrigues (Eds.). *Manual para a Construção de Jardins Interiores*. Lisboa: Fundação Calouste Gulbenkian.

Rogers, R. (2013). *Digital Methods*. Cambridge, MA: MIT Press.

Romero-Fresco, P. (2020). The dubbing effect: an eye-tracking study on how viewers make dubbing work. *The Journal of Specialised Translation*, 33, 17-40.

Rose, E., Weinert, S., & Ebert, S. (2018). The roles of receptive and productive language in children's socioemotional development. *Social Development*, 27(4), 777-792.

Roskos, K. Burstein, K., Shang, Y., & Gray, E. (2014). Young Children's Engagement with E-Books at School: Does Device Matter? *SAGE Open*, 4(1).

Roskos, K., Burstein, K., & You, B. (2012). A Typology for Observing Children's Engagement with eBooks at Preschool. *Journal of Interactive Online Learning*, 11(2), 47-66.

Samudra, P. G., Flynn, R. M., & Wong, K. M. (2019). Coviewing Educational Media: Does Coviewing Help Low-Income Preschoolers Learn Auditory and Audiovisual Vocabulary Associations? *AERA Open*, 5(2), 1-12.

Samudra, P. G., Wong, K. M., & Neuman, S. B. (2020). Is attention the missing link? Coviewing and preschoolers' comprehension of educational media. *Journal of Applied Developmental Psychology*, 67, 101108.

Schafer, M. (1967). *Ear cleaning: Notes for an experimental music course*. Toronto: Berandol Music Limited.

Schlesinger, M. A., Flynn, R. M., & Richert, R. A. (2016). US preschoolers' trust of and learning from media characters. *Journal of Children and Media*, 10(3), 321-340.

Shiue, I. (2015). Duration of daily TV/screen watching with cardiovascular, respiratory, mental and psychiatric health: Scottish Health Survey, 2012–2013. *International Journal of Cardiology*, 186, 241–246.

Shultz, T. R. (1972). The role of incongruity and resolution in children's appreciation of cartoon humor. *Journal of Experimental Child Psychology*, 13, 456-477.

Silva, I.L., Marques, L. Mata, L., & Rosa, M. (2016). *Orientações Curriculares para a Educação Pré-Escolar*. Ministério da Educação / Direção Geral da Educação (DGE).

Sim-Sim, I. (1997). *Avaliação da Linguagem Oral: um contributo para o conhecimento do desenvolvimento linguístico das crianças portuguesas*. Lisboa: Fundação Calouste Gulbenkian.

Sim-Sim, I. (1998). *Desenvolvimento da Linguagem*. Lisboa: Universidade Aberta.

Smith, E., Duede, S. Hanrahan, S., Davis, T., House, P., & Greger, B. (2013). Seeing is believing: Neural representations of visual stimuli in human auditory cortex correlate with illusory auditory perceptions. *PLoS ONE*, 8(9), e73148.

- Sousa, D. A. (2017). *How the Brain Learns*. London: SAGE.
- Steemers, J. (2011). Little Kids' TV: Downloading, Sampling, And Multiplatforming the Preschool TV Experiences of the Digital Era. In J. Bennet & N. Strange (Eds.), *Television as Digital Media*. Durham: Duke University Press.
- Steemers, J. (2016). Production studies, transformations in children's television and the global turn. *Journal of Children and Media*, 10(1), 123-131.
- Stockwell, P. (2002). *Cognitive Poetics: An introduction*. London/New York: Routledge.
- Strouse, G. A., O'Doherty, K., & Troseth, G. L. (2013). Effective coviewing: Preschooler's learning from video after a dialogic questioning intervention. *Developmental Psychology*, 49(12), 2368-2382.
- Tafesse, W. (2020). YouTube marketing: how marketers' video optimization practices influence video views. *Internet Research*, 30(6), 1689-1707.
- Temban, M. M., Hua, T. K., & Said, N. E. M. (2021). Exploring informal learning Opportunities via YouTube Kids among children during COVID-19. *Academic Journal of Interdisciplinary Studies*, 10(3), 272-287.
- Tokuhamma-Espinosa, T. (2011). *Mind, Brain, and Education Science: a comprehensive guide to the new brain/based teaching*. London/New York: W. W. Norton & Company, Kindle Edition
- Tomasello, M. (2003). *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Harvard University Press.
- Tomasello, M. (2008). *Origins of Human Communication*. Cambridge, Massachusetts/London: MIT Press.
- Troseth, G. L., & Deloache, J. S. (1998). The medium can obscure the message: young children's understanding of video. *Child Development*, 69, 950-965.
- Troseth, G. L., Saylor, M. M., Archer, A. H. (2006). Young children's use of videos as a source of socially relevant information. *Child Development*, 77, 786-799.

Valerio, W., Reynolds, A., Bolton, B., Taggart, C., & Gordon, E. (2000). *Music Play: The early childhood music curriculum guide for parents, teachers and caregivers*. Chicago: GIA Publications.

Viana, F. L., Silva, C., Ribeiro, I., & Cadime, I. (2017). Instrumentos de avaliação da linguagem: uma perspectiva global. In M. J. Freitas, & A. L. Santos (Eds.), *Aquisição de língua materna e não materna: Questões gerais e dados do português*. Berlin: Language Science Press, 333-357.

Vygotsky, L. S., & Cole, M. (1981). *Mind in society: The development of higher psychological processes*. Cambridge, Mass: Harvard Univ. Press.

Wadsworth, B. J. (2004). *Piaget's theory of cognitive and affective development: Foundations of constructivism*. New York: Longman.

Wartella, E., & Robb, M. (2008). Historical and Recurring Concerns about Children's Use of the Mass Media. In S. L. Calvert, S. L. & B. J. Wilson (Eds.), *The Handbook of children, Media and Development*. Chichester: Wiley-Blackwell. Kindle Edition.

Wartella, E., Rideout, V., Lauricella, A., & Connell, S. (2014). *Parenting in the Age of Digital Technology: A National Survey [Revised]*. Report of the Center on Media and Human Development. School of Communication, Northwestern University.

Wright, J. C., Huston, A. C., Ross, R. P., Calvert, S. L., Rolandelli, D., Weeks, L. A., Raeissi, P., & Potts, R. (1984). Pace and continuity of television programs: Effects on children's attention and comprehension. *Developmental Psychology*, 20(4), 653–666.

Zhou, R., Khemmarat, S., Gao, L., Wan, J., & Zhang, J. (2016). How YouTube videos are discovered and its impact on video views. *Multimedia Tools and Applications*, 75, 6035-6058.

Zillmann, D., & Bryant, J. (2013). Guidelines for the Effective Use of Humor in Children's Educational Television Programs. In P. E. McGhee (Ed.), *Humor and Children's Development: A Guide to Practical Applications*. London/New York: Routledge. [1989]

APPENDIX 1

Script of the video stimuli (Study 1)

Study 1 – Scripts

V1 1.1. Interior. Tarde. Quarto de brincar.

LEO – (Está à procura de algo no meio de brinquedos e instrumentos. De repente, para e olha para a câmara.) Olá! Que bom que estás aqui comigo! Estou à procura do Kazoo, que é o meu instrumento musical favorito! (*Insert da imagem do Kazoo em pós-produção.*) Queres ajudar-me? Sim? Boa! Sabes o que é um Kazoo? Um Kazoo é um instrumento pequenino que faz sons muito engraçados, basta soprar para dentro dele! Mas não sei onde o deixei... (continua a procurar, até olhar para ele.) Ah! O Kazoo está aqui! Ouve o som que ele faz! (Toca no Kazoo.) Obrigado por me ajudares a encontrar o meu Kazoo!

V2 1.1. Interior. Cenário branco.

URSO – Olá! Olha, uma flauta! (Toca na flauta.) Olha, um violino! (Toca no violino.) Olha, um kazoo! (Toca no kazoo.) (Olha para a câmara.) Queres ouvir outra vez? Uma flauta... (Toca na flauta.) Um violino... (Toca no violino.) Um kazoo! (Toca no kazoo.) (Olha para a câmara.) Mais uma vez? Uma flauta... (Toca na flauta.) Um violino... (Toca no violino.) Um kazoo! (Toca no kazoo.) Adeus!

V3 1.1. Interior. Tarde. Quarto de brincar.

LEO – (Está à procura de algo no meio de brinquedos e instrumentos. Começa a falar para si mesmo, sem nunca olhar para a câmara.) Hmm... onde estará o meu Kazoo? (Pega na flauta.) Não é isto... (Pega no violino.) Também não é isto... (Pega na maraca.) Também não é isto... (Pega no kazoo.) Ah! Está aqui! (Toca no Kazoo.)

V4 Ordem das vinhetas: flauta, maracas, kazoo, violino, piano.

Study 2 – Script

V1 1.1. Interior. Tarde. Quarto de brincar.

LEO – (Está à procura de algo no meio de brinquedos e instrumentos. De repente, para e olha para a câmara.) Olá! Que bom que estás aqui comigo! Estou à procura do Ukulele, que é o meu instrumento musical favorito! (*Insert da imagem do Ukulele em pós-produção.*) Queres ajudar-me? Sim? Boa! Sabes o que é um Ukulele? Um Ukulele é um instrumento que tem cordas e faz um som bonito quando tocamos nele! Mas não sei onde o deixei... (continua a procurar, até olhar para ele.) Ah! O Ukulele está aqui! Ouve o som que ele faz! (Toca no Ukulele.) Obrigado por me ajudares a encontrar o meu Ukulele!

Study 3 – Script

V1; 1.1. Interior. Tarde. Quarto de brincar.

V1.1

LEO – (Está à procura de algo no meio de brinquedos e instrumentos. De repente, para e olha para a câmara.) Olá! Que bom que estás aqui comigo! Estou à procura do Pau-de-chuva, que é o meu instrumento musical favorito! (*Insert da imagem do Pau-de-chuva em pós-produção.*) Queres ajudar-me? Sim? Boa! Sabes o que é um Pau-de-chuva? Um Pau-de-chuva é um instrumento que faz um som parecido com o da chuva a cair, basta virá-lo para um lado e para o outro! Mas não sei onde o deixei... (continua a procurar, até olhar para ele.) Ah! O Pau-de-chuva está aqui! Ouve o som que ele faz, parece mesmo o som da chuva! (Toca no Pau-de-chuva.) Obrigado por me ajudares a encontrar o meu Pau-de-chuva!

Study 4 – Scripts

V1 1.1. Interior. Tarde. Quarto de brincar.

LEO – (Está à procura de algo no meio de brinquedos e instrumentos. De repente, para e olha para a câmara.) Olá! Que bom que estás aqui comigo! Estou à procura da Maraca, que é o meu instrumento musical favorito! (*Insert da imagem da Maraca em pós-produção.*) Queres ajudar-me? Sim? Boa! Sabes o que é uma Maraca? Uma Maraca é um instrumento que faz um som muito engraçado, basta agitá-la! Mas não sei onde a deixei... (continua a procurar, até olhar para ela.) Ah! A Maraca está aqui! Ouve o som que ela faz! (Toca na Maraca.) Obrigado por me ajudares a encontrar a minha Maraca!

V1.1; 1.1. Interior. Cenário branco.

V1.2

LEO – (Is looking for something in the middle of toys and instruments. Suddenly, he stops and looks at the camera.) Hi! I'm so glad you're here with me! I'm looking for the Maraca, which is my favorite musical instrument! (*Insert of the image of the Maraca in post-production.*) Can you help me? Yes? Good! Do you know what a Maraca is? A Maraca is an instrument that makes a very funny sound. You just have to shake it! But I don't know where I left it... (Leo keeps on looking until he looks at it.) Ah! The Maraca is here! Listen to the sound it makes! (*Shakes the Maraca.*) Thanks for helping me finding my Maraca!

APPENDIX 2

Independent-samples proportions test – group-paired (Study 1)

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS1 = 1	= 1	30	31	,968	,032
	= 2	13	27	,481	,096

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	,486	,101	,257	,656
	Newcombe	,486	,101	,265	,662

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,486	,101	4,219	<,001	<,001

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS1 = 1	= 1	30	31	,968	,032
	= 3	27	31	,871	,060

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	,097	,068	-,056	,238
	Newcombe	,097	,068	-,054	,258

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,097	,068	1,399	,081	,162

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS1 = 1	= 1	30	31	,968	,032
	= 4	24	34	,706	,078

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	,262	,084	,074	,416
	Newcombe	,262	,084	,081	,432

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,262	,084	2,812	,002	,005

Independent-Samples Proportions Group Statistics						
	Group	Successes	Trials	Proportion	Asymptotic Standard Error	
ScoreS1 = 1	= 1	30	31	,968	,032	
	= 5	2	27	,074	,050	

Independent-Samples Proportions Confidence Intervals					
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	,894	,060	,698	,973
	Newcombe	,894	,060	,688	,953

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,894	,060	6,826	<,001	<,001

Independent-Samples Proportions Group Statistics						
	Group	Successes	Trials	Proportion	Asymptotic Standard Error	
ScoreS1 = 1	= 2	13	27	,481	,096	
	= 3	27	31	,871	,060	

Independent-Samples Proportions Confidence Intervals					
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	-,389	,113	-,585	-,147
	Newcombe	-,389	,113	-,580	-,150

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	-,389	,113	-3,198	<,001	,001

Independent-Samples Proportions Group Statistics						
	Group	Successes	Trials	Proportion	Asymptotic Standard Error	
ScoreS1 = 1	= 2	13	27	,481	,096	
	= 4	24	34	,706	,078	

Independent-Samples Proportions Confidence Intervals					
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	-,224	,124	-,448	,024
	Newcombe	-,224	,124	-,439	,021

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	-,224	,124	-1,782	,037	,075

Independent-Samples Proportions Group Statistics						
	Group	Successes	Trials	Proportion	Asymptotic Standard Error	
ScoreS1 = 1	= 2	13	27	,481		,096
	= 5	2	27	,074		,050

Independent-Samples Proportions Confidence Intervals						
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference		
				Lower	Upper	
ScoreS1 = 1	Agresti-Caffo	,407	,109	,166		,592
	Newcombe	,407	,109	,171		,594

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,407	,109	3,342	<,001	<,001

Independent-Samples Proportions Group Statistics						
	Group	Successes	Trials	Proportion	Asymptotic Standard Error	
ScoreS1 = 1	= 3	27	31	,871		,060
	= 4	24	34	,706		,078

Independent-Samples Proportions Confidence Intervals						
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference		
				Lower	Upper	
ScoreS1 = 1	Agresti-Caffo	,165	,099	-,040		,348
	Newcombe	,165	,099	-,038		,350

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,165	,099	1,617	,053	,106

Independent-Samples Proportions Group Statistics						
	Group	Successes	Trials	Proportion	Asymptotic Standard Error	
ScoreS1 = 1	= 3	27	31	,871		,060
	= 5	2	27	,074		,050

Independent-Samples Proportions Confidence Intervals						
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference		
				Lower	Upper	
ScoreS1 = 1	Agresti-Caffo	,797	,079	,580		,910
	Newcombe	,797	,079	,571		,891

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,797	,079	6,055	<,001	<,001

Independent-Samples Proportions Group Statistics					
	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS1 = 1	= 4	24	34	,706	,078
	= 5	2	27	,074	,050

Independent-Samples Proportions Confidence Intervals					
	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS1 = 1	Agresti-Caffo	,632	,093	,404	,778
	Newcombe	,632	,093	,400	,768

Independent-Samples Proportions Tests						
	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS1 = 1	Wald H0	,632	,093	4,956	<,001	<,001

APPENDIX 3

Independent-samples proportions test – group-paired (Study 2)

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
Score S2 = 1	= 1	23	29	,793	,075
	= 2	29	34	,853	,061

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
Score S2 = 1	Agresti-Caffo	-,060	,097	-,250	,132
	Newcombe	-,060	,097	-,255	,129

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
Score S2 = 1	Wald H0	-,060	,097	-,624	,266	,533

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
Score S2 = 1	= 1	23	29	,793	,075
	= 3	27	31	,871	,060

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
Score S2 = 1	Agresti-Caffo	-,078	,096	-,266	,117
	Newcombe	-,078	,096	-,271	,115

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
Score S2 = 1	Wald H0	-,078	,096	-,809	,209	,419

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
Score S2 = 1	= 1	23	29	,793	,075
	= 4	6	30	,200	,073

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
Score S2 = 1	Agresti-Caffo	,593	,105	,350	,761
	Newcombe	,593	,105	,346	,744

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
Score S2 = 1	Wald H0	,593	,105	4,556	<,001	<,001

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
Score S2 = 1	= 2	29	34	,853	,061
	= 3	27	31	,871	,060

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
Score S2 = 1	Agresti-Caffo	-,018	,086	-,188	,157
	Newcombe	-,018	,086	-,191	,162

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
Score S2 = 1	Wald H0	-,018	,086	-,210	,417	,834

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
Score S2 = 1	= 2	29	34	,853	,061
	= 4	6	30	,200	,073

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
Score S2 = 1	Agresti-Caffo	,653	,095	,427	,803
	Newcombe	,653	,095	,421	,786

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
Score S2 = 1	Wald H0	,653	,095	5,236	<,001	<,001

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
Score S2 = 1	= 3	27	31	,871	,060
	= 4	6	30	,200	,073

Independent-Samples Proportions Confidence Intervals

		Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
Interval Type				Lower	Upper
Score S2 = 1	Agresti-Caffo	,671	,095	,441	,818
	Newcombe	,671	,095	,436	,802

Independent-Samples Proportions Tests

		Difference in Proportions	Asymptotic Standard Error	Z	Significance	
	Test Type				One-Sided p	Two-Sided p
Score S2 = 1	Wald H0	,671	,095	5,257	<,001	<,001

APPENDIX 4

Video editing details (Study 3.1)

Clip no.	Series	Episode title	Link	Total Lenght	Shot no.	Scene Type	Shot Type	Shot Lenght
1	<i>Blue's Clues & You!</i>	Musical Instrument Mix Up Game w/ Josh and Blue!	https://www.youtube.com/watch?v=vjcyDukaFAQ&list=PLUAW-YemAgxiFrK9YNp88tM3y3SeoMdeO&index=4	04:57	1	Dialogue	Full Shot	00:43
					2	Dialogue	Medium Shot	00:38
					3	Dialogue	Medium Shot	00:25
					4	Dialogue	Medium Shot	00:05
					5	Dialogue	Medium Shot	00:03
					6	Dialogue	Medium Shot	00:25
					7	Dialogue	Cowboy Shot	01:27
					8	Dialogue	Medium Closeup	00:19
					9	Song	Full Shot	00:15
					10	Dialogue + Song	Medium Shot	00:28
					11	Dialogue	Medium Shot	00:06
					12	Dialogue	Medium Shot	00:03
2	<i>Blue's Clues & You!</i>	Learn How Oranges Grow w/ Josh, Blue, Mr. Salt & Mrs. Pepper!	https://www.youtube.com/watch?v=f3cpFMNbneY&list=PLUAW-YemAgxiFrK9YNp88tM3y3SeoMdeO&index=1	04:40	1	Dialogue	Cowboy Shot	00:55
					2	Dialogue	Medium Closeup	00:04
					3	Dialogue	Cowboy Shot	00:33
					4	Dialogue	Medium Closeup	00:14
					5	Dialogue	Cowboy Shot	00:07
					6	Dialogue	Medium Closeup	00:06
					7	Dialogue	Full Shot	00:11
					8	Dialogue	Closeup	00:02
					9	Dialogue	Medium Closeup	00:07

					10	Dialogue	Cowboy Shot	00:23
					11	Dialogue	Cowboy Shot	00:38
					12	Dialogue	Medium Shot	00:22
					13	Dialogue	Closeup	00:20
					14	Dialogue	Medium Closeup	00:38
3	<i>Blue's Clues & You!</i>	Learn ASL w/ Josh & Blue Sign Language for Kids Blue's Clues & You!	https://www.youtube.com/watch?v=LzqfTmG-aio&list=PLUAW-YemAgxiFrK9YNp88tM3y3SeoMdeO&index=11	04:23	1	Song	Medium Closeup	00:07
					2	Song	Closeup	00:02
					3	Song	Medium Closeup	00:22
					4	Song	Closeup	00:02
					5	Song	Medium Closeup	00:28
					6	Dialogue	Medium Closeup	00:05
					7	Dialogue	Medium Shot	00:07
					8	Dialogue	Medium Closeup	00:05
					9	Dialogue	Closeup	00:03
					10	Dialogue	Medium Shot	00:16
					11	Dialogue	Medium Closeup	00:06
					12	Dialogue	Closeup	00:11
					13	Dialogue	Closeup	00:07
					14	Dialogue	Medium Closeup	00:05
					15	Dialogue	Closeup	00:06
					16	Dialogue	Medium Shot	00:09
					17	Dialogue	Medium Closeup	00:05
					18	Dialogue	Medium Shot	00:02
					19	Song	Full Shot	00:16
					20	Dialogue	Medium Closeup	00:05
					21	Dialogue	Closeup	00:03
					22	Dialogue	Closeup	00:13
					23	Dialogue	Extreme Closeup	00:01

					24	Dialogue	Medium Closeup	00:05
					25	Song	Medium Shot	00:04
					26	Song	Full Shot	00:14
					27	Dialogue	Medium Closeup	00:05
					28	Dialogue	Medium Closeup	00:25
					29	Dialogue	Medium Closeup	00:05
					30	Dialogue	Medium Closeup	00:13
					31	Dialogue	Medium Closeup	00:03
					32	Dialogue	Medium Closeup	00:03
4	Sesame Street	Colors Elmo's World	https://www.youtube.com/watch?v=MeO8Vlx-jXA	04:46	1	Dialogue	Medium Closeup	00:14
					2	Dialogue	Full Shot	00:18
					3	Dialogue	Medium Closeup	00:15
					4	Dialogue	Closeup	00:04
					5	Dialogue	Closeup	00:05
					6	Dialogue	Medium Closeup	00:12
					7	Other	Full Shot	00:03
					8	Other	Medium Closeup	00:01
					9	Other	Medium Shot	00:02
					10	Other	Medium Closeup	00:04
					11	Other	Closeup	00:02
					12	Other	Full Shot	00:02
					13	Other	Closeup	00:01
					14	Other	Full Shot	00:02
					15	Other	Medium Shot	00:02
					16	Other	Closeup	00:02
					17	Other	Medium Shot	00:01
					18	Other	Closeup	00:02
					19	Other	Closeup	00:01
					20	Other	Extreme	00:02

							Closeup	
						21	Other	Closeup 00:02
						22	Other	Extreme Closeup 00:02
						23	Other	Closeup 00:01
						24	Other	Extreme Closeup 00:01
						25	Other	Extreme Closeup 00:03
						26	Other	Closeup 00:01
						27	Other	Extreme Closeup 00:01
						28	Other	Medium Shot 00:06
						29	Dialogue	Medium Closeup 00:09
						30	Dialogue	Closeup 00:07
						31	Dialogue	Medium Closeup 00:12
						32	Game	Closeup 00:56
						33	Dialogue	Medium Shot 00:27
						34	Other	Medium Shot 00:06
						35	Other	Full Shot 00:01
						36	Other	Medium Closeup 00:03
						37	Other	Full Shot 00:01
						38	Other	Medium Closeup 00:02
						39	Other	Full Shot 00:01
						40	Other	Medium Closeup 00:05
						41	Other	Full Shot 00:03
						42	Other	Medium Closeup 00:15
						43	Song	Full Shot 00:09
						44	Dialogue	Medium Closeup 00:08
						45	Song	Full Shot 00:09
5	Sesame Street	Counting Elmo's World	https://www.youtube.com/watch?v=SjNigBmumLM	04:46	1	Dialogue	Medium Closeup	00:14
					2	Dialogue	Full Shot	00:33
					3	Dialogue	Medium Closeup	00:04

					4	Dialogue	Closeup	00:08					
					5	Dialogue	Medium Closeup	00:22					
					6	Other	Full Shot	00:05					
					7	Other	Closeup	00:03					
					8	Other	Closeup	00:03					
					9	Other	Medium Shot	00:06					
					10	Other	Full Shot	00:06					
					11	Dialogue	Medium Closeup	00:09					
					12	Dialogue	Closeup	00:06					
					13	Dialogue	Medium Closeup	00:15					
					14	Game	Closeup	00:55					
					15	Dialogue	Medium Closeup	00:21					
					16	Other	Full Shot	00:02					
					17	Other	Medium Shot	00:07					
					18	Other	Full Shot	00:06					
					19	Other	Medium Shot	00:03					
					20	Other	Full Shot	00:03					
					21	Other	Medium Shot	00:03					
					22	Other	Full Shot	00:08					
					23	Other	Medium Shot	00:06					
					24	Other	Medium Shot	00:10					
					25	Song	Full Shot	00:09					
					26	Dialogue	Medium Closeup	00:08					
					27	Song	Full Shot	00:11					
					6	Sesame Street	Instruments Elmo's World	https://www.youtube.com/watch?v=_1MXjw5hX3Q	04:46	1	Dialogue	Medium Closeup	00:14
										2	Dialogue	Full Shot	00:22
										3	Dialogue	Medium Closeup	00:29
4	Dialogue	Closeup	00:02										
5	Other	Medium Shot	00:04										
6	Other	Medium Shot	00:04										

					7	Other	Closeup	00:02
					8	Other	Extreme Closeup	00:02
					9	Other	Medium Shot	00:01
					10	Other	Full Shot	00:03
					11	Other	Closeup	00:04
					12	Other	Medium Shot	00:05
					13	Other	Medium Shot	00:02
					14	Other	Full Shot	00:06
					15	Dialogue	Medium Closeup	00:14
					16	Dialogue	Medium Closeup	00:04
					17	Dialogue	Medium Closeup	00:12
					18	Game	Closeup	00:55
					19	Dialogue	Medium Closeup	00:23
					20	Other	Medium Shot	00:06
					21	Other	Full Shot	00:09
					22	Other	Medium Shot	00:04
					23	Other	Full Shot	00:02
					24	Other	Medium Shot	00:01
					25	Other	Full Shot	00:04
					26	Other	Medium Shot	00:01
					27	Other	Full Shot	00:11
					28	Dialogue	Medium Closeup	00:12
					29	Song	Full Shot	00:09
					30	Dialogue	Medium Closeup	00:08
					31	Song	Full Shot	00:11

APPENDIX 5

Independent-samples proportions test – group-paired (Study 3.2)

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS3 = 1	= 1	33	34	,971	,029
	= 2	28	28	1,000	,000

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS3 = 1	Agresti-Caffo	-,029	,029	-,121	,076
	Newcombe	-,029	,029	-,149	,094

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS3 = 1	Wald H0	-,029	,029	-,915	,180	,360

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS3 = 1	= 1	33	34	,971	,029
	= 3	11	30	,367	,088

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS3 = 1	Agresti-Caffo	,604	,093	,386	,753
	Newcombe	,604	,093	,389	,754

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS3 = 1	Wald H0	,604	,093	5,202	<,001	<,001

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS3 = 1	= 2	28	28	1,000	,000
	= 3	11	30	,367	,088

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS3 = 1	Agresti-Caffo	,633	,088	,412	,771
	Newcombe	,633	,088	,418	,781

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS3 = 1	Wald H0	,633	,088	5,135	<,001	<,001

APPENDIX 6

Independent-samples proportions test – group-paired (Study 4)

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS4 = 1	= 1	17	17	1,000	,000
	= 2	15	16	,938	,061

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS4 = 1	Agresti-Caffo	,063	,061	-,118	,235
	Newcombe	,063	,061	-,129	,283

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS4 = 1	Wald H0	,063	,061	1,047	,148	,295

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS4 = 1	= 1	17	17	1,000	,000
	= 3	20	22	,909	,061

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS4 = 1	Agresti-Caffo	,091	,061	-,094	,238
	Newcombe	,091	,061	-,105	,278

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS4 = 1	Wald H0	,091	,061	1,276	,101	,202

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS4 = 1	= 1	17	17	1,000	,000
	= 4	7	22	,318	,099

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS4 = 1	Agresti-Caffo	,682	,099	,400	,828
	Newcombe	,682	,099	,403	,836

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS4 = 1	Wald H0	,682	,099	4,340	<,001	<,001

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS4 = 1	= 2	15	16	,938	,061
	= 3	20	22	,909	,061

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS4 = 1	Agresti-Caffo	,028	,086	-,183	,210
	Newcombe	,028	,086	-,202	,223

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS4 = 1	Wald H0	,028	,086	,321	,374	,748

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS4 = 1	= 2	15	16	,938	,061
	= 4	7	22	,318	,099

Independent-Samples Proportions Confidence Intervals

	Interval Type	Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
				Lower	Upper
ScoreS4 = 1	Agresti-Caffo	,619	,116	,318	,794
	Newcombe	,619	,116	,316	,782

Independent-Samples Proportions Tests

	Test Type	Difference in Proportions	Asymptotic Standard Error	Z	Significance	
					One-Sided p	Two-Sided p
ScoreS4 = 1	Wald H0	,619	,116	3,818	<,001	<,001

Independent-Samples Proportions Group Statistics

	Group	Successes	Trials	Proportion	Asymptotic Standard Error
ScoreS4 = 1	= 3	20	22	,909	,061
	= 4	7	22	,318	,099

Independent-Samples Proportions Confidence Intervals

		Difference in Proportions	Asymptotic Standard Error	95% Confidence Interval of the Difference	
Interval Type				Lower	Upper
ScoreS4 = 1	Agresti-Caffo	,591	,117	,311	,772
	Newcombe	,591	,117	,311	,759

Independent-Samples Proportions Tests

		Difference in	Asymptotic		Significance	
Test Type		Proportions	Standard Error	Z	One-Sided p	Two-Sided p
ScoreS4 = 1	Wald H0	,591	,117	4,025	<,001	<,001

APPENDIX 7

Materials used in Study 5 (questionnaire)

1. No seu agregado familiar existem uma ou mais crianças em idade pré-escolar (3, 4 ou 5 anos)?

Sim

--

Não

--

Nota: Se a sua resposta foi "não", o questionário termina aqui. Muito obrigada pela sua participação.

Para responder às questões seguintes, por favor considere apenas o que se refere às crianças em idade pré-escolar.

2. Em que canais na Internet costuma procurar vídeos educativos para a(s) criança(s) do seu agregado familiar?

YouTube

--

Google

--

Vimeo

--

Facebook

--

Instagram

--

Outros (por favor, especifique)

--

Não utilizo nenhum canal na internet

Nota: Se a sua resposta foi "não utilizo nenhum canal na internet", o questionário termina aqui. Muito obrigada pela sua participação.

3. Com que frequência costuma procurar na Internet vídeos educativos para a(s) criança(s) do seu agregado familiar?

Muito frequentemente (diariamente)

--

Frequentemente (várias vezes por semana)

--

Ocasionalmente (semanalmente)

--

Raramente (mensalmente)

--

Nunca

--

4. Que características valoriza num vídeo educativo? (Pode seleccionar mais do que uma opção.)

Ser um vídeo divertido

--

Ser um vídeo seguro, sem conteúdos inapropriados para a idade da criança

--

Ser um vídeo de uma marca (ou personagem) já conhecida

--

Ter personagens que a criança conhece e de que a criança gosta

--

Promover a aquisição de competências que serão posteriormente trabalhadas na escola (leitura, matemática, entre outras)

Promover a aquisição de competências artísticas (música, dança, entre outras)

Promover a aquisição de competências socioculturais (relações positivas com os outros, entre outras)

Outras (por favor, especifique)

5. Quando procura recomendações sobre vídeos educativos, a que fontes recorre? (Pode seleccionar mais do que uma opção.)

Amigos e/ou familiares

Educadores

Redes sociais

Blogs e websites

Recomendações a partir de outros vídeos

Outras (por favor, especifique)

6. Quando procura um vídeo educativo para crianças no YouTube, que palavras ou expressões costuma introduzir? (Indique até 5, separando-as por vírgulas, por favor.)

Resposta 1:

Resposta 2:

Resposta 3:

Resposta 4:

Resposta 5:

7. Com que frequência costuma visitar os websites das marcas dos vídeos educativos que a criança vê, ou das suas personagens?

Muito frequentemente (diariamente)

Frequentemente (várias vezes por semana)

Ocasionalmente (semanalmente)

Raramente (mensalmente)

Nunca

8. Com que frequência costuma visitar os perfis de redes sociais das marcas dos vídeos educativos que a criança vê, ou das suas personagens?

Muito frequentemente (diariamente)

Frequentemente (várias vezes por semana)

Ocasionalmente (semanalmente)

Raramente (mensalmente)

Nunca

9. O que valoriza mais no website de uma marca ou personagem de um vídeo educativo? (Pode seleccionar mais do que uma opção.)

Jogos

Imagens para colorir

Recomendações para pais
 Atividades para toda a família
 Comprar merchandising (roupa, brinquedos, etc.)
 Obter informação sobre outras atividades associadas (concertos ou outros eventos ao vivo, por exemplo)
 Ser informado de novos vídeos em produção
 Outros (por favor, especifique)

10. O que valoriza mais no perfil de uma rede social de uma marca ou personagem de um vídeo educativo? (Pode selecionar mais do que uma opção.)

Jogos
 Imagens para colorir
 Recomendações para pais
 Atividades para toda a família
 Comprar merchandising (roupa, brinquedos, etc.)
 Obter informação sobre outras atividades associadas (concertos ou outros eventos ao vivo, por exemplo)
 Ser informado de novos vídeos em produção
 Outros (por favor, especifique)

11. Indique até 3 marcas ou personagens de vídeos educativos que conheça (Caso não conheça nenhuma, deixe em branco, por favor).

Marca ou Personagem 1:
Marca ou Personagem 2:
Marca ou Personagem 3:

12. Com que frequência a(s) criança(s) do seu agregado familiar utiliza(m) o smartphone para ver vídeos educativos?

Muito frequentemente (diariamente)
 Frequentemente (várias vezes por semana)
 Ocasionalmente (semanalmente)
 Raramente (mensalmente)
 Nunca

13. Com que frequência a(s) criança(s) do seu agregado familiar utiliza(m) o tablet para ver vídeos educativos?

Muito frequentemente (diariamente)
 Frequentemente (várias vezes por semana)
 Ocasionalmente (semanalmente)
 Raramente (mensalmente)
 Nunca

14. Com que frequência a(s) criança(s) do seu agregado familiar utiliza(m) o computador para ver vídeos educativos?

Muito frequentemente (diariamente)

--

Frequentemente (várias vezes por semana)
 Ocasionalmente (semanalmente)
 Raramente (mensalmente)
 Nunca

15. Qual é a sua região de residência?

Norte
 Centro
 Área Metropolitana de Lisboa
 Alentejo
 Algarve
 Açores
 Madeira
 Outra (fora de Portugal)

16. Que idade tem? (A pessoa que responde a este questionário.)

Idade:

17. Qual é o seu género?

Feminino
 Masculino
 Outro

18. Quais são as suas habilitações literárias? (A pessoa que responde a este questionário.)

Ensino Básico
 Ensino Secundário
 Ensino Profissional
 Licenciatura ou equivalente
 Mestrado
 Doutoramento

19. Qual a idade e género da(s) criança(s) que compõe(m) o seu agregado familiar?

Criança 1

Idade:
Género:
Grau de Parentesco:

Criança 2

Idade:
Género:
Grau de Parentesco:

Criança 3

Idade:
Género:
Grau de Parentesco:

20. Com quem vive(m) a(s) criança(s) em idade pré-escolar do seu agregado familiar?

(Por favor, assinale tudo o que for aplicável. Se viver com mais de um avô, avó, irmão, irmã, tio, tia, primo ou prima, coloque no campo "idade" as diferentes idades de cada um dos elementos.)

Vive com:		Idade(s)
Pai		
Mãe		
Padrasto		
Madrasta		
Avô		
Avó		
Irmão		
Irmã		
Tio		
Tia		
Primo		
Prima		
Outro: _____		

APPENDIX 8

Statistics of Study 5

		Statistics						
		2.1.Youtube	2.2.Google	2.3.Vimeo	2.4.Facebook	2.5.Instagram	2.6.Other	2.6.1.Specify
N	Valid	134	134	134	134	134	134	134
	Missing	0	0	0	0	0	0	0

		Statistics	
		2.7.Do not use Internet channels	2.8.No_opinion
N	Valid	134	134
	Missing	0	0

Frequency Table

2.1.Youtube

	N	%
No	6	4,5%
Yes	128	95,5%

2.2.Google

	N	%
No	92	68,7%
Yes	42	31,3%

2.3.Vimeo

	N	%
No	130	97,0%
Yes	4	3,0%

2.4.Facebook

	N	%
No	127	94,8%
Yes	7	5,2%

2.5.Instagram

	N	%
No	129	96,3%
Yes	5	3,7%

2.6.Other

	N	%
No	128	95,5%
Yes	6	4,5%

2.6.1.Specify

	N	%
	130	97,0%
Escola virtual	1	0,7%
Pinterest	2	1,5%
Zero em comportamento	1	0,7%

2.7.Do not use Internet channels

	N	%
No	132	98,5%
Yes	2	1,5%

2.8.No_opinion

	N	%
No	133	99,3%
Yes	1	0,7%

Statistics

3.SearchFrequency_EducationalVideos

N	Valid	134
	Missing	0

3.SearchFrequency_EducationalVideos

	N	%
	4	3,0%
About once a month	12	9,0%
Almost Everyday	71	53,0%
At least once a week	47	35,1%

Statistics

	4.1.FunVideos	4.2.SafeVideo_AppropriateVideo	4.3.VideoKnownBrand/Character	4.4.Charactersthewasliked	4.5.Promotes_School_Competences	4.6.Promotes_Artistic_Competences
N	134	134	134	134	134	134
Valid	134	134	134	134	134	134
Missing	0	0	0	0	0	0

Statistics

	4.7.Promotes_Sociocultural_Competences	4.8.Other	4.9.No_opinion
N	134	134	134
Valid	134	134	134
Missing	0	0	0

Frequency Table

4.1.FunVideos

	N	%
No	66	49,3%
Yes	68	50,7%

4.2.SafeVideo_AppropriateVideo

	N	%
No	25	18,7%
Yes	109	81,3%

4.3.VideoKnownBrand/Charachter

	N	%
No	114	85,1%
Yes	20	14,9%

4.4.Characterers_liked

	N	%
No	78	58,2%
Yes	56	41,8%

4.5.Promotes_School_Competences

	N	%
No	61	45,5%
Yes	73	54,5%

4.6.Promotes_Artistic_Competences

	N	%
No	38	28,4%
Yes	96	71,6%

4.7.Promotes_Sociocultural_Competences

	N	%
No	68	50,7%
Yes	66	49,3%

4.8.Other

	N	%
No	134	100,0%

4.9.No_opinion

	N	%
No	130	97,0%
Yes	4	3,0%

Statistics

		5.1.Friends_and _Family	5.2.Educators_T eachers	5.3.Social_Netw orks	5.4.Blogs_Webs ites	5.5.Recommend ation_from_othe r_videos	5.6.Other
N	Valid	134	134	134	134	134	134
	Missing	0	0	0	0	0	0

Statistics

		5.7.No_opinion
N	Valid	134
	Missing	0

Frequency Table

5.1.Friends_and_Family

	N	%
No	44	32,8%
Yes	90	67,2%

5.2.Educators_Teachers

	N	%
No	88	65,7%
Yes	46	34,3%

5.3.Social_Networks

	N	%
No	99	73,9%
Yes	35	26,1%

5.4.Blogs_Websites

	N	%
No	99	73,9%
Yes	35	26,1%

5.5.Recommendation_from_other_videos

	N	%
No	102	76,1%
Yes	32	23,9%

5.6.Other

	N	%
No	133	99,3%
Yes	1	0,7%

5.7.No_opinion

	N	%
No	131	97,8%
Yes	3	2,2%

Descriptive Statistics

	N	Sum
6.1.Education(General)	82	178
6.2.Dance	15	18
6.3.Music	42	46
6.4.VisualArts	15	16
6.5.Cartoons	23	44
6.6.Games	17	17
6.7.Other	17	22
6.8.No_opinion	14	14

Valid N (listwise)	0
--------------------	---

		Statistics	
		7.Visits_Website_Brands	8.Visits_SocialNetworks_Brands
N	Valid	134	134
	Missing	0	0

Frequency Table

7.Visits_Website_Brands		
	N	%
About once a month	5	3,7%
Almost Everyday	42	31,3%
At least once a week	34	25,4%
Never	39	29,1%
	14	10,4%

8.Visits_SocialNetworks_Brands		
	N	%
About once a month	2	1,5%
Almost Everyday	55	41,0%
At least once a week	18	13,4%
Never	24	17,9%
	35	26,1%

		Statistics					
		9.1.Games	9.2.Coloring_Pages	9.3.Recommendations_for_parents	9.4.Activities_for_the_whole_family	9.5.Buy_Merchandise	9.6.Information_about_related_activities
N	Valid	134	134	134	134	134	134
	Missing	0	0	0	0	0	0

		Statistics					
		9.7._Information_about_the_production_of_new_videos	9.8.Other	9.9.No_opinion	10.1.Games	10.2.Coloring_Pages	10.3.Recommendations_for_parents
N	Valid	134	134	134	134	134	134
	Missing	0	0	0	0	0	0

		Statistics					
		10.4.Activities_for_the_whole_family	10.5.Buy_Merchandise	10.6.Information_about_related_activities	10.7._Information_about_the_production_of_new_videos	10.8.Other	10.9.No_opinion
N	Valid	134	134	134	134	134	134
	Missing	0	0	0	0	0	0

Frequency Table

9.1.Games

	N	%
No	62	46,3%
Yes	72	53,7%

9.2.Coloring_Pages

	N	%
No	66	49,3%
Yes	68	50,7%

9.3.Recommendations_for_parents

	N	%
No	91	67,9%
Yes	43	32,1%

9.4.Activities_for_the_whole_family

	N	%
No	72	53,7%
Yes	62	46,3%

9.5.Buy_Merchandise

	N	%
No	129	96,3%
Yes	5	3,7%

9.6.Information_about_related_activities

	N	%
No	102	76,1%
Yes	32	23,9%

9.7._Informaton_about_the_production_of_new_videos

	N	%
No	133	99,3%
Yes	1	0,7%

9.8.Other

	N	%
No	134	100,0%

9.9.No_opinion

	N	%
No	123	91,8%
Yes	11	8,2%

10.1.Games

	N	%
No	78	58,2%
Yes	56	41,8%

10.2.Coloring_Pages

	N	%
No	84	62,7%
Yes	50	37,3%

10.3.Recommendations_for_parents

	N	%
No	89	66,4%
Yes	45	33,6%

10.4.Activities_for_the_whole_family

	N	%
No	75	56,0%
Yes	59	44,0%

10.5.Buy_Merchandise

	N	%
No	131	97,8%
Yes	3	2,2%

10.6.Information_about_related_activities

	N	%
No	105	78,4%
Yes	29	21,6%

10.7._Informaton_about_the_production_of_new_videos

	N	%
No	124	92,5%
Yes	10	7,5%

10.8.Other

	N	%
No	133	99,3%
Yes	1	0,7%

10.9.No_opinion

	N	%
No	115	85,8%
Yes	19	14,2%

		Statistics		
		11.1.Brand1	11.2.Brand2	11.3.Brand3
N	Valid	134	134	134
	Missing	0	0	0

Frequency Table

11.1.Brand1		
	N	%
	66	49,3%
A Sala do Girassol	1	0,7%
Aqui há gato	1	0,7%
Baby TV	1	0,7%
Bina	1	0,7%
Bing	1	0,7%
Blippi	1	0,7%
Bolinha de Música	2	1,5%
casa do Mickey - músicas	1	0,7%
Casa Teehee	1	0,7%
Dá a Mão à Floresta	1	0,7%
Daniel o Tigre	1	0,7%
Disney	2	1,5%
Disney Junior	1	0,7%
Drawing to draw	1	0,7%
Escola virtual	1	0,7%
Escolinha Educateira	1	0,7%
Heidi	1	0,7%
Helen Doron	1	0,7%
Hot Wheels	1	0,7%
Joãozinho (personagem)	1	0,7%
Jodo	1	0,7%
Jurassic World	1	0,7%
Looney Tunes	1	0,7%
Lucas Neto	2	1,5%
Maria de Vasconcelos	1	0,7%
Mickey	1	0,7%
Nick Jr. Em português	1	0,7%
O Vasco	1	0,7%
Os sons interiores/exteriores	1	0,7%
Ovelha Choné	1	0,7%
Panda	21	15,7%
Panda e os Caricas	3	2,2%
Patrulha Pata	4	3,0%
Pocoyo	1	0,7%
Porquinha Pepa	1	0,7%
Slim Sam	1	0,7%
Smile and Learn	1	0,7%
Super Simple	1	0,7%
Toca like Do Wo	1	0,7%
Tró-Tró	1	0,7%

11.2.Brand2

	N	%
	81	60,4%
A Carrinha Mágica	1	0,7%
Artecedário	1	0,7%
Avô Cantigas	1	0,7%
Baby Bus	1	0,7%
Baby First	1	0,7%
Baby Shark	1	0,7%
Bing	1	0,7%
Blippy	2	1,5%
Brink & Aprende	1	0,7%
Canções da Maria	1	0,7%
Caninópolis	1	0,7%
Clementoni	1	0,7%
Dama e o Vagabundo	1	0,7%
Disney	1	0,7%
Dora	1	0,7%
Doutora Brinquedos	1	0,7%
Draw It	1	0,7%
Helen Doron	1	0,7%
Histórias do Saltaetrinhas	1	0,7%
hora do conto - aqui há gato	1	0,7%
Hot Wheels	1	0,7%
Jim Jam	1	0,7%
Júlia Silva	1	0,7%
Lara no País da Música	3	2,2%
Luccas Neto	1	0,7%
Panda	5	3,7%
Panda e os caricas	1	0,7%
Panda e os Caricas	1	0,7%
Patrulha Pata	2	1,5%
Playkids	2	1,5%
Pocoyo	2	1,5%
Porquinha Pepa	3	2,2%
Poupas	1	0,7%
Show da Luna	1	0,7%
Smile and Learn	1	0,7%
Talking Tom	1	0,7%
Tia Flá	1	0,7%
Tró-Tró	1	0,7%
Xana Toc-Toc	3	2,2%

11.3.Brand3

	N	%
	100	74,6%
A Patrulha Pata	1	0,7%
Baby Shark	1	0,7%
Baby TV	1	0,7%
Bluey	1	0,7%
Brink & Aprende	1	0,7%
Disney Channel	1	0,7%
Gabi e a casa das bonecas	1	0,7%
Hey Duggee	1	0,7%
Joãozinho	1	0,7%
Lady Bug	1	0,7%
Lego	1	0,7%
Masha e o Urso	2	1,5%

Mundo curioso - Discovery Kids	1	0,7%
Músicas da Carochinha	1	0,7%
Nic e Inês	1	0,7%
Number Blocks	1	0,7%
Panda	5	3,7%
Patrulha Pata	2	1,5%
Ping Song	1	0,7%
PJ Masks	1	0,7%
Pocoyo	3	2,2%
Porquinha Pepa	1	0,7%
Spiderman	1	0,7%
TBN Kinder	1	0,7%
Totox Kids	1	0,7%
Zig-Zag	1	0,7%

Statistics

		12.Frequency_of_smartphone_to_EducationalVideos	13.Frequency_of_tablet_to_EducationalVideos	14.Frequency_of_Computer_to_EducationalVideos
N	Valid	134	134	134
	Missing	0	0	0

Frequency Table

12.Frequency_of_smartphone_to_EducationalVideos

	N	%
	4	3,0%
About once a month	24	17,9%
Almost Everyday	59	44,0%
At least once a week	38	28,4%
Never	9	6,7%

13.Frequency_of_tablet_to_EducationalVideos

	N	%
	4	3,0%
About once a month	20	14,9%
Almost Everyday	48	35,8%
At least once a week	31	23,1%
Never	31	23,1%

14.Frequency_of_Computer_to_EducationalVideos

	N	%
	4	3,0%
About once a month	39	29,1%
Almost Everyday	10	7,5%
At least once a week	15	11,2%
Never	66	49,3%

APPENDIX 9

Script of main part A of the pilot episode

1.1. LIVE-ACTION. INTERIOR. TARDE. QUARTO DE BRINCAR DE LARA.

LARA está sentada no chão do quarto, junto da janela, com os olhos fechados. Passado algum tempo, LEO entra de forma ruidosa. Ao vê-la sentada no chão e de olhos fechados, fica muito admirado e aproxima-se dela pé ante pé. Senta-se ao pé dela e olha para ela com um ar admirado. Ouve-se som de chuva.

LEO – (**Olha para a câmara** e mostra-se agradavelmente surpreendido. **Acena para a câmara**, a cumprimentar o espetador.) Olá! Que bom que estás aqui connosco! (Aponta para Lara.) O que é que ela estará a fazer? (**Vira-se para Lara** e fala alto.) O que é que estás a fazer, Lara?

LARA – (Dá um pequeno salto no chão, assustada. Abre os olhos e ri-se.) Ai! Assustaste-me, Leo! Chiu! (Volta-se para a frente.) Estou a escutar o som da chuva. Consegues ouvir? Fecha os olhos e escuta comigo. (Fecha os olhos.)

LEO – (Vira-se para a frente, fecha os olhos e põe-se a escutar.) Sim, consigo ouvir a chuva! A chuva tem um som bonito... (Ouve-se o som de um pássaro.) Olha! Também consigo ouvir um pássaro! (Abre os olhos e fala **diretamente para a câmara**.) Tu também ouves este pássaro? (Volta a fechar os olhos.)

LARA – (Ri-se, mantendo os olhos fechados.) É divertido fechar os olhos, fazer silêncio e escutar o que está à nossa volta. (Pausa.)

LEO – (Ouve-se um trovão. O Leo assusta-se e abre os olhos.) Que medo! Ouviste este trovão, Lara?

LARA – (Abre os olhos e ri-se.) Claro que ouvi! É um som tão forte! CABUUUUMMMM! (Ri-se novamente.)

LEO – Eu tenho muito medo da trovoada.

LARA – Não tenhas medo, Leo. A trovoada não te vai fazer mal. Eu sei que assusta porque é um som *forte*, mas aqui em casa estamos protegidos. Se fosse um som *fraco* já não te assustava.

LEO – Então... há sons que são fortes e outros que são fracos? Não sei se percebo...

LARA – Vou-te explicar, Leo. (Lara fala **diretamente para a câmara**.) Há sons que são fortes porque fazem muito barulho, como o som do trovão. Assim: CABUUUUMMMM. Há outros sons que fazem pouco barulho e por isso são fracos, como quando contamos um segredo. Assim. (Lara diz baixinho para a câmara “isto é um som fraco”, semelhante a um sussurro contado ao ouvido.)

LEO – Ah! Então há sons fortes, que fazem muito barulho e sons fracos, que fazem pouco barulho. É isso?

LARA – É mesmo isso, Leo, muito bem! Vamos fazer um jogo! Eu mostro-te um desenho e vamos ouvir um som e tu dizes-me se o que ouviste foi um som forte ou um som fraco. (Fala **diretamente para a câmara**.) E tu também me vais dizer se é um som forte ou fraco, combinado? Vamos lá!

LEO – Vamos!

LARA – (Tira o desenho de um despertador de dentro da caixa.) Vou mostrar o primeiro desenho. (Mostra para a câmara o desenho do despertador e ouve-se o som do despertador. Pausa.) Então, este é um som forte ou um som fraco?

LEO – Isso é um despertador e um despertador faz um som forte!

LARA – Muito bem! (Pousa o desenho do despertador e pega no desenho de um pássaro.) E este? (Mostra para a câmara o desenho do pássaro e ouve-se o som de um pássaro a cantar. Pausa.)

LEO – Isso é um pássaro e um pássaro faz um som fraco!

LARA – Boa! (Pousa o desenho do pássaro e pega no desenho de um sino.) E este, é um som forte ou fraco? (Mostra o desenho do sino e ouve-se o som de um sino. Pausa.)

LEO – Isso é um sino e um sino faz um som forte!

LARA – Muito bem! (Pousa o desenho do sino e pega no desenho de um gato.) E este? (Mostra o desenho do gato e ouve-se o som de um gato a miar. Pausa.)

LEO – Isso é um gato e quando o gato mia faz um som fraco!

LARA – (Ri-se, contente.) Muito bem! (Pousa o desenho do gato.)

APPENDIX 10

Script of the summary of the pilot episode

1.2. LIVE-ACTION. INTERIOR. TARDE. QUARTO DE BRINCAR DE LARA.

Lara e Leo estão sentados no chão, a brincar.

LARA – Sabes, Leo, nós também conseguimos fazer sons fortes e sons fracos.

LEO – Ah, sim, Lara?! Então como?!

LARA – Então, por exemplo, se eu disser (fala alto) OLÁ, estou a fazer um som forte, mas se eu disser (fala baixo) olá, estou a fazer um som fraco. Ora experimenta lá. (Fala **diretamente para a câmara**.) E tu, experimenta também! Tens de dizer o meu nome a fazer um som forte.

LEO – (Fala alto.) LARA.

LARA – (Ri-se.) Muito bem! E agora tens de dizer o meu nome a fazer um som fraco. Tenta lá.

LEO – (Fala baixo.) Lara.

LARA – (Ri-se.) Boa! É mesmo isso!

LEO – (Recomeça a brincar.) (Fala alto.) LARA! (Fala baixo.) Lara. (Fala alto.)

LARA! (Fala baixo.) Lara. (Fala alto.) LARA! (Fala baixo.) Lara.

LARA – (Ri-se e recomeça a brincar. Fala **diretamente** para a câmara.)

Brincar aos sons fortes e fracos é tão divertido! Experimenta!

APPENDIX 11

Sons fortes e sons fracos [Loud and soft sounds] – lyrics

(Music and lyrics by Gisela Canelhas)

Quando bato com força os pés no chão,

(PUM PUM)

Quando faço muito barulho ao espirrar,

(ATCHIM)

É um som que não é fraco,

É um som que é bem forte,

É um som que é capaz de te assustar.

(CABUM!)

Mas quando oiço um passarinho a piar,

(Piu piu)

Ou o meu gatinho a miar assim,

(Miau miau)

É um som que não é forte,

É um som que é bem fraco,

É o som de um segredo para mim.

(Shh shh)

PUM PUM, ATCHIM, CABUM, PUM!

Piu piu, miau miau, shh shh, sss.

PUM PUM, ATCHIM, CABUM, PUM!

Piu piu, miau miau, shh shh, sss.