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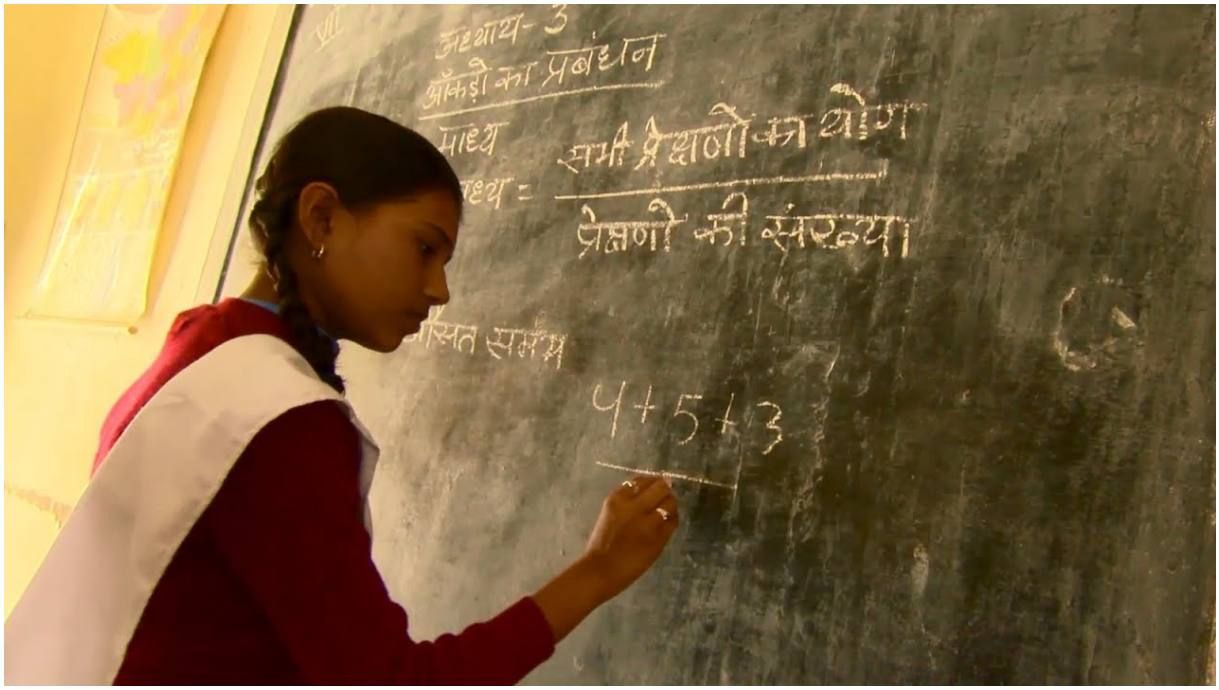

The potential of technology to reduce the quality gap between rural and urban schools in India

A case study on Meghshala,

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1. Introduction

"Education is the passport to the future, for tomorrow belongs to those who prepare for it today" (Malcom X, 1964). This quote perfectly describes the importance of education, not only to the individual, but also to society at large. Human capital is increasingly becoming the crucial factor for nations' long-term economic growth, in which education plays the main factor (Aghion, Boustan, Hoxby, & Vandenbussche, 2009). India has a large and young population, which is an incredible opportunity for a country to take advantage of its' economic dividend. In fact, 13% of its population is within teenage years, compared to 8% in China and 7% in Europe. The urgency to provide quality education becomes even more evident when taking ASER's (2016) findings into account, which state that children's futures are sealed by the third year of attending school. Unfortunately, India's education system is failing its students, leaving millions of young pupils lacking crucial skills and knowledge (The Economist, 2017a). As the access to technology, and hence the access to information, has become more affordable and wide-spread around the globe; scholars, government officials and entrepreneurs have put more hope in technology as a mean to overcome these shortcomings in the educational sector. This thesis strives to evaluate how technology can impact the educational landscape in India. More specifically, it delves into the research question how technology can help to reduce the quality gap between urban and rural schools in India. In order to gain some contextual insights, the thesis will focus on the work of the NGO Meghshala, which delivers interactive educational content through its Android app, while trying to support teachers in their daily job.

First, the Indian education system and its main characteristics will be outlined. Second, the status quo of the system with a focus on its weaknesses will be described. Furthermore, the paper will analyze three areas in more depth, which hinder India in delivering a high quality and relevant education to its' masses. Third, a review on technology in educational systems and its' promises is undertaken. The paper will then outline the methodology with which the

research was conducted. Fifth, the results of the research will be outlined, followed by the discussion of this section and finally a conclusion will be drawn.

2. The Indian Education System

India's education system is the second largest in the world, being responsible for the education of 230 million pupils in 1.4 million schools scattered across the country. 28% of the Indian population is below 14 years old and thus fall within the primary school and upper primary school / middle school bracket (Parruck, 2014). From the age of five to six years, children ought to receive a four to five-year education, aiming to teach them basic reading, writing, mathematics, as well as social science skills. After primary school pupils proceed to upper primary school, where they are lectured in more subject-specific topics next to their basic education (Parruck, 2014). Education from primary to upper primary school, i.e. till the 8th grade, is universally compulsory and free of charge all over India, as the Right To Educational Act (RTE) directs (Scholaro, 2012).

3. Status Quo of the Indian education system and main challenges

Despite universal and free education, which has led to a Gross Enrollment Ratio (GER) of above 100 percent in primary education, India's education system varies widely in the quality of content delivery and ranks poorly on many metrics (Swarup, 2016). According to him, the Indian government was able to tilt the gender parity index (GPI) in favor of female students, who are now in the slight majority in primary and secondary schools with an index of 1.03 and 1.01, respectively. Unfortunately, these positive achievements are being overshadowed by multiple low scoring metrics in the Indian education system. Pupils from urban schools continuously outperform their peers from rural ones, across the four metrics of English, Mathematics, Science and Social Sciences (Swarup, 2016, P. 9). To make matters worse, Parruck (2016) argues that there are steep dropout rates after primary schooling and high disadvantages towards deprived groups in society. The Economist (2017a) adds that half of India's nine-year olds cannot figure out simple summations, half of ten-year olds are unable to

read a simple paragraph meant for seven-year olds and the average 15-year-old would rank in the lower 2% of American classes of the same age group. Despite India investing 80% more in public schooling between 2011 and 2015, the quality of education generally remains poor (The Economist, 2017a). The Indian Prime Minister Narendra Modi promised to increase public spending on education to 6% of the national GDP, however, with the current 2.7% spending of GDP India still has a long way to go (The Economist, 2017a & Pradhan, 2018). Pradhan suggests that higher levels of investment are necessary, to overcome the sectors chronic problems, such as the country's low teacher to pupil ratio which is one of the lowest in comparison to the other BRICS countries (Trines, 2018).

3.1. Shortcomings of the schooling system

The Indian education system is a product of its former colonial occupation by the British empire (The Economist, 2017a). The shortcomings that have emerged from the narrow focus on higher education, which serves only a selected few, keeps on impacting today's education system. According to Meghshala (2018), the government struggles to deliver a high quality and holistic education to its one million schools across the country. Part of the problem is that resources are inefficiently allocated due to the *Right to Education Act* (RTE) of 2009, which requires a public primary school to be within a one-kilometer radius of each village, resulting in 5000 empty schools, and explaining why one third of Indian schools have less than 50 pupils. This also results in teachers being responsible for teaching a class of different age and different knowledge levels. This inefficient spending becomes even more apparent when considering that India has 35% more pupils than China, yet four times of China's schools (The Economist, 2017b).

According to The Economist (2017b), accountability is another major source of concern in the Indian education system, as both the central and state government are responsible for schooling outcomes, yet none of these two bodies holds itself accountable for them. Additionally, one fourth of teachers fail to show up to work and are not held liable for doing so. The reason for

this cannot be attributed to low pay, as public-school teachers have witnessed a doubling of their wages over the past two pay negotiations, often amounting to ten times the local median wage (The Economist, 2017a & 2017b). Many teachers bribe the overmighty teachers union or local government officials in exchange for political support campaigns, hence having little to fear for low performance.

3.2.Training of Teachers

Despite the skewed teacher performance evaluation system and the lack of their accountability, many try to improve the learning outcomes of their students yet are hindered by the poor education they have received themselves. The low quality of institutions responsible for the education of teachers, also called Teacher Education Institutions (TEI), can be partly attributed to accountability and corporate governance issues. While the federal government determines the broad policy and legal framework on teachers' education, the implementation of the schemes and programs is vastly undertaken by the state. The whole system is overlooked by the National Council of Teacher Education (NCTE), which is in charge of defining standards for educational classes for teachers, the minimum qualifications for teachers, as well as the evaluation of course content and the legitimacy of institutions (Ministry of Human Resource Development , 2018). Since the NCTE was created in 1993 with the aim of increasing the supply of teachers, the number of Teacher Education Institutions (TEI) has increased from 1,500 to over 16,000 in 2011, of which 90% are private institutions (NCTE, n.d. & Behar, 2017). According to Batra, a member of the commission on teachers' education appointed by the Supreme Court, only 10% of these TEIs are professional institutions (Kohli, 2016). Part of the problem is that the current accreditation process, which evaluates TFIs, grants these institutions the lifetime right to operate. Furthermore, the terms under which certain institutions might have received permission to operate are no longer up to date. For instance, if a school was granted the right to educate 100 pupils in a certain location 15 years ago, the school might currently educate 200 pupils in a completely different location. According to Mathew, the chairman of the National Council for Teacher Education, the organization is currently "*flying blindly*" as

updated information and controls on institutions are out of place. In response to the quality and accreditation issues of TFIs, the ministry of human resource development decided to put the accreditation of new training institutions on hold for a year and focus on reevaluating already existing and authorized institutions (Chowdhury, 2017).

The education of teachers can be broadly divided into the areas of pre-service and in-service education. While the first aims its focus on equipping pupils with the necessary skills for the teaching profession, the latter one provides teachers with ongoing trainings to keep up with changes in learning materials and best practices (Samhita, 2016). Unfortunately, both areas of education are not working properly. Samhita criticizes that pre-service education for teachers is of too short duration, lacks opportunities to gain practical experiences, while failing to present pupils the social realities of classrooms. Critics go further, stating that teachers are only provided with basic skills, expecting them to apply them to any given context and putting aside pedagogical aspects about how children actually learn best. Mentorship programs and field experiences could help overcome these pitfalls in the education system, prepare teachers for the ground reality and learn best practices from experienced teachers, however, these programs are also absent in the Indian education system. As for the in-service education, teachers are required to take 20 days annually on additional trainings. However, Samhita criticizes that the outcomes of the trainings are laxly defined and there is limited standardization, resulting in high quality disparities.

As a result of the poor education that teachers across the country receive, less than 20 percent of teachers passed the nationwide Teachers Eligibility Test (TET). This should be an alarming fact for state governments, as teachers clearly did not receive the necessary competencies to execute the job they were hired for. Yet, out of the 29 states in India, 14 have opted out of evaluating their candidates by taking this test. Through this rotation of many teachers, they are

unable to fully understand the needs of their pupils, while at the same time reducing the incentive for them to remain dedicated to their job (Akash, 2016).

According to Mathew, the current Chairman of the National Council for Teacher Education, numerous steps are taken in order to improve the situation of low-quality teacher education. The most important step should be a national portal, which requires teachers to upload the teaching materials and exams they use. Furthermore, a semi-annual national ranking of institutions will be created, allowing students to rank their schools, thus rewarding strong ones and punishing the ones unable to deliver a high-quality education. Finally, auditors and observers will be put into place to evaluate schools and their test scores. In order to evaluate these schools, randomly chosen students will be asked to take test exams, thus allowing the government to mirror schools against these sample scores (Chowdhury, 2017).

3.3. Disparities in access to learning materials between urban and rural schools

Rural India is characterized by the prevalence of agriculture, which has been the primary income source of families across the country. However, as people realize the potential to break out of poverty by attaining an education, the number of children enrolled in schools has been on the rise, most of them first-generation learners (Krishna, 2018). Due to a lack of financial support from their parents, rural children are dependent on free government education in rural areas. This is problematic, as government schools usually perform much worse than many private schools do, and kids are left with little to no alternatives to improve their learning outcomes (Target Study, n.d.). Rural schools clearly offer less opportunities to its pupils than urban ones, mainly due to divergences in the quality of the infrastructure, the access to learning materials and the limitations of teaching in urban areas itself. According to Target Study, rural schools suffer from multiple infrastructure problems, due to a lack of funding. These often include a limited access to schools due to seasonal variations, a lower access to learning centers, limited availability of water and electricity supplies as well as rudimentary teaching supplies such as blackboards and furniture. Data to illustrate rural schools' infrastructure problems is

provided by the ASER (2016, P. 56) report, which annually analyzes the nations quality of rural schools, surveying 350,000 households scattered across the country. The infrastructure of a country's schools is crucial, since it has strong effect on the ability for children to learn. First, the access to electricity is still a major hurdle for many schools; only 67.9% of visited schools had a connection to an electric grid, while 25% of these schools had no electricity available on the day of the visit. Second, especially in a hot country such as India, the access to clean drinking water for school children is crucial. In India, 74.1 percent of public schools had access to drinking water, while an astonishing 26 percent of schools had either no drinking water facility at all or the facility was dysfunctional at the day of the survey. Third, public schools are required to provide a free lunch for children attending schools, which nearly 90 percent of pupils in public schools receive (ASER, 2016, P. 56). However, Bist (2017) points out that the downside of the compulsory lunch is that teachers are required to cook for their pupils, thus reducing the time they can spend on teaching. Fourth, sanitary facilities are crucial for students' well-being, yet only 68.7 percent of public schools had usable toilets, whereas the number is even lower, for separate girls' bathrooms at 61.9 percent. Finally, in the digital age the usage of computers and IT technology plays an increasingly important role for the jobs of today and tomorrow. Yet, in only 8.1 percent of schools' computers were available for the use and education of pupils.

Apart from the poor infrastructure often found in public rural schools, there are also issues in terms of access to the same quality of education. According to the ASER (2016), 40 percent of the primary government schools visited were "small schools", meaning that there were less than 60 pupils enrolled in it. The trend of shrinking schools has gone hand in hand with the increase in multi-grade classrooms, meaning that various grades receive their schooling at the same time in the same classroom. More specifically, the proportion of second graders who were sharing their classroom with other grades was 63.7% and 58% for fourth graders (ASER, 2016, P. 56). Attendance of both, teachers and pupils is yet another major issue in rural schooling, and should

be seen as a better indicator of the school's quality than enrollment. Pupils are often not attending as they are left behind in class or because they do not see the value in what they learn. Furthermore, one third of rural schools have only one teacher, meaning that the occurrence of classes is dependent on the teacher showing up to work (Target Study, n.d.). ASER (2016, P.56) measured that attendance is a major issue for the national education system, with an average of 71.4% of children and 85.6% of teachers being present. Furthermore, rural schools suffer from an absence of high-quality teaching and learning materials, which hinders the country in delivering a unified learning system, catering to all socio-economic backgrounds (Bandyopadhyay, n.d.). For instance, many of the textbooks which students use are given to them in English, despite the low English knowledge level of pupils (Banerjee, 2017). Not only is the language of textbooks a problem, but also children's ability to read in general, as they are not capable of following what is written on the blackboard, while being forced to sit in classes which do not meet their knowledge level (ASER, 2016). As a result, a majority of students (57%), drop out when they move up to secondary school levels (Bandyopadhyay, n.d.). Finally, despite an improved level of education for rural areas, urban environments strongly outperform them in terms of attained education (Hnatkovskay & Lahiriy, 2013, P. 9). This in turn implies that people in rural areas will struggle to escape poverty and improve their living situation.

4. The promise of technology to improve education on a large scale

The problems of the Indian education system, which were highlighted in section three, are deeply rooted and difficult to overcome. However, with the vast spread of technology throughout society and its' increasingly dominant role in everyone's life, technology has also become a source of optimism for educational bodies around the world to overcome these problems. As Lone (2017) highlights, India faces an enormous challenge in regard to access to high quality education from primary educational levels to college. This, amongst the reasons pointed out in section three of this paper, can be attributed to the vast geographical distribution of pupils across India, socio-economic conditions and the increasing costs that the government

faces with India's large and growing population. Kavishwar (2018) illustrates how technology would enable teachers to deliver information remotely to a large audience of students, and hence fill the void of 907,585 primary and 106,906 secondary vacant teacher positions. Furthermore, he adds that technology could be a solution to make lessons more interesting, interactive and value adding to pupils, as disinterest in studies accounts for 20.24% of out of school children in India. Finally, he addresses the potential of technology to overcome numerous of the aforementioned infrastructure shortcomings of Indian schools, such as the lack of high-quality teaching materials while improving individual learnings of students all at a lower cost.

Despite these possibilities that technology holds, the results of using technology in the classroom are not all positive, often resulting in wasted investments. Trucano (2014) criticizes that technology solutions are often imported from wealthier countries and made to fit in more difficult areas, such as rural classrooms in developing countries. These solutions are too expensive to be replicated on a larger scale or do not manage to have a real impact on students and their learning. Furthermore, Coughlan (2015) cites the OECD's findings, after which the very frequent usage of computers actually decreases the performance of pupils in class. Moreover, he states that the best performing schooling systems around the world have been very careful about implementing technology in their classrooms. However, the report also found that students who used computers on a regular basis, such as once or twice per week, had better learning outcomes, than students who did not use them at all. It is crucial to take these findings with a grain of salt, however, as developing countries are facing fundamentally different challenges in their education systems than developing countries. Trucano (2013) suggest multiple principles and approaches which should be considered before the introduction of ICTs into remote, low-income educational environments. He argues that the best technology to reach these areas is the one which is already in use, which people know how to use, and which is affordable. Through this Trucano wants to prevent that expensive technology is imported, while people might not be able to use it properly and gains could be achieved through less expensive

means. Adding to this, he recommends that educational technology initiatives should be implemented on site to gain early inputs on what works and what does not, before they are scaled up. Furthermore, Trucano criticizes that too often teachers are seen as the problem to shortcomings in schools. However, he recommends an approach based on the collaboration with teachers over the confrontation with them, as it is easier to work with another party than to work against it. Finally, he highlights the need to focus on the content over the "container" that delivers the content, in order to increase the long-term sustainability of educational technology projects (Trucano, 2013).

Likely the best-known example of a successful educational technology product is Khan Academy. The NGO offers free videos on subjects such as math and various sciences, providing high quality educational materials to millions. In fact, Khan Academy has grown to become a multi-million-dollar organization, impacting over 10 million students each month both in- and after-school activities. The range of their offering extends to 100,000 exercise problems, over 5,000 videos readily available on YouTube and a personal learning dashboard (Trucano, 2014b). There are numerous other ways through which NGOs and governments try to address better education through the usage of technology. For instance, in Peru The World Bank evaluated the One Laptop per Child program, which intends to supply each child with a laptop at a cost of $100 (Trucano, 2012). Despite a substantial increase of school and at home usage of laptops, and hence an increased digital literacy, there was no impact on school enrollments or math and language skills. However, cognitive skills, verbal fluency and coding skills improved. A more affordable mean of bringing educational access to remote areas is the interpersonal computer, which enables multiple users to interact with individual input devices with one display simultaneously (Alcoholado, Diaz, Tagle, Nussbaum, & Infante, 2016). According to these authors, the technology has proven itself successful at creating an interactive learning environment amongst students at a cost of $1 per child per year. In their conducted study, the kind of feedback and the speed of feedback received by students through different

methods of content delivery were compared; namely through the usage of personal computers (instant and private feedback), interpersonal computers (instant but public feedback) and traditional pen and paper (delayed and private feedback). Even though the test group that was solely using pen and paper as their teaching and assessment system had the highest initial test scores, the results that stand out are the interpersonal and personal computer groups. These received instantaneous feedback during their learning process and were able to correct mistakes as they were made. This indicates that regardless of the form of feedback (personal vs. group), students using technology receive instant feedback and were able to improve the most (Alcoholado, Diaz, Tagle, Nussbaum, & Infante, 2016, P. 98). Another reason for the stronger increase in schooling performance amongst technology users is the more interactive and individualized learning environment that technology creates through the required interaction of individual student with the system. In fact, Alcoholado, et al. (2011) evaluated the One Mouse per Child program in India and Chile and its impact on improving students' arithmetic performance over time. They found that the groups of students with the lowest initial test results showed the strongest improvements over time with 25.53% better test scores. According to the authors of this journal article, this allows poor performing students to catch up with their more advanced peers, while not slowing down more progressed learners. Alcoholado, et al. argue that this can be attributed to the system's ability to reinforce content that individual students need to work on most, hence generating a personalized learning path. Finally, with the spread of mobile devices through the world fueled by their growing affordability, and advances in network coverage in rural areas, many organizations try to bring educational content to users via the Android Playstore. For instance, Amrita's Rural Teacher Training Program aims to train teachers to become change-agents in children's education in rural India, through the usage of tablets. The organization uses mobile learning technology in teaching to improve the quality of education in remote areas (Menon, Nedungdi, & Raman, 2017). More specifically, the program trains teachers in digitally supported teaching methods, the management of multi-aged

classrooms, the development of students critical thinking as well as finding suiting learning modalities. According to Menon, Nedungdi and Raman, the science test scores of pupils in multiple regions increased considerably after the intervention of the Amrita. Furthermore, teachers were able to understand individual learning needs more accurately and support children with learning disabilities.

4.1. Introduction to Meghshala

Meghshala is an NGO located in Bangalore, India, focusing on delivering high quality primary- and upper primary education materials to student in the state of Karnataka. It does so through its app, which teachers can download on their android devices and share the content with pupils using a supplied projector. Before the NGO launched its app, they supplied teachers with tablets on which they could find preloaded content. Thus, the new solution can be compared to a cloud solution which allows for the collection of data and the continuous updating of content, whereas the old one resembled more of an on-premise solution. The app has been downloaded more than 20,000 times with an active install base of 4,812 users. Meghshala provides materials for the subjects of Math, English, Science and Social Studies, by providing multimedia teach kits for class usage. These multimedia kits consist of images, videos, activities, and strategies targeted at turning the classroom into a more interactive learning environment. Furthermore, the NGO aims to inspire teachers to pick up new skills and cultivate empathy for pupils learning. Furthermore, the app introduces an innovative way for kids to engage in class while at the same time providing in-class support to teachers. It does so by suggesting novel ways for teachers to execute their lessons and provides contextual trainings fitting the classrooms lessons (Meghshala, 2018b).

5. Methodology

Equipped with a broad overview over the Indian education system, the main challenges that it faces and the promises that technology holds for improving it, this thesis now aims to illustrate how the work of Meghshala can help to overcome some of these obstacles. More specifically, the paper tries to show that technology could improve the Indian education system on a large

scale. In order to do so, the thesis will follow the *Unified Theory of Acceptance and Use of Technology (UTAUT)* model (figure 1) based on the approach of Holden's and Karsh's research (2010, P. 165) and additionally draw upon external data to support the hypothesis outlined above. A survey was conducted amongst primary school teachers in government schools using Meghshala, to which 68 people responded. After cleaning the data from irrelevant answers or repeated responses, the dataset includes 57 subjects**.** The survey was conducted anonymously, and all questions were voluntary to answer. The questions were designed to understand the four moderating factors of the technology's acceptance by users following the UTAUT model, namely: *perceived usefulness, perceived ease of use, social influences and facilitating conditions*. The model is ideal for this thesis, as the moderating factors can help to understand aspects influencing the acceptance of the technology and hence its impact. Furthermore, the moderating factor of *perceived usefulness* can also help to understand the impact users observe using the Meghshala app. These questions were designed for two reasons: To support the overall methodology and approach of the technology acceptance model, but also to analyze the usefulness and impact that teachers are able to subjectively observe. The survey was split into four parts, each set of questions answering one of the four moderating factors (Appendix 2). Furthermore, in order to support the research, external data supplied by Meghshala was used. Gray Matters (2017) assessed the performance of 461 students in Math and Science over a one-year period. More specifically, the organization compared the performance of schools using the Meghshala service (treatment group) with the performance of schools who did not (control group). Moreso, Meghshala collected data about all of its' users, from the login location to the number of hours the app was used over time. These external data sources are used in order to illustrate the actual impact of Meghshala on students' performance as well as the spread of their service facilitated by technology. Limitations of this research include the small sample size, which can partly be attributed to language barriers and hence the willingness to fill out an English survey. Furthermore, the external data, supplied by Meghshala relies on different

respondents than the survey, as it was difficult the receive test scores of students due to privacy and legal concerns of the NGO. Moreover, the survey relies on subjective assessments of the Meghshala service, which again can be attributed to the difficulty of gaining access to students' performance through the government. However, the sample size of Gray Matter is quite significant, and despite the narrow focus on Math and Science over a one-year period, the survey is able to deliver interesting insights about the impact of Meghshala on students. In order to enable respondents to answer questions as truthfully as possible, the survey was conducted anonymously. Finally, Meghshala is located in Bangalore, meaning that its efforts are primarily focused on the state of Karnataka, where the majority its users are located.

6. Results

6.1. Survey results: Subjective evaluation of Meghshala by teachers

Of the respondents 52% were females and 48% were male, where the average school size was 212 pupils, with a minimum of 21 and a maximum of 503 pupils. The corresponding ratio of students per teacher yielded an average of 28 students per teacher with a minimum of 11 and a maximum of 51. Figure 5 shows that in 30 percent of cases there were more than 31 students per teacher, while in the majority of cases there were 21-30 students per teacher. Furthermore, 61% of teachers stated that they were teaching in multi-grade classrooms. When analyzing the first moderating factor, *perceived usefulness*, the majority of respondents replied positively about the apps helpfulness in educating multi-grade classrooms (Table 1). More specifically, 72% of respondents answered with helpful or very helpful for question 6. The majority of these respondents had rather large classrooms with more than 30 students in them. Furthermore, the majority of respondents rated the content of the app to be good or very good, as figure 6 displays. Additionally, teachers seem to witness real impact on students learning outcomes, through the usage of the Meghshala app in the class environment, leading to better understanding and higher retention rates amongst students (figure 7). This seems to be especially true for understanding the content in the first place. Despite this, the app seems to have less of an impact on the attendance of students in class, than it does on pupils' learning

outcomes. Still, many teachers believe there is a change in attendance attributed to the usage of Meghshala (figure 7). For the second factor, *perceived ease of use*, the respondents seem to be in favor of the application as well. On average teachers responded with a score of 3.9 to question 12 and with a score of 2.4 to question 13, indicating that the usage of the app is intuitive and does not require much effort. However, it seems that there are a few respondents who think the app requires a lot of effort to use in the classroom (figure 8). The third mediator, *Social Influence,* seems to support the adoption of the application as well. Generally, parents support the usage of technology in the classrooms of their children. Furthermore, children themselves seem to be more interested in class when using technology, hence encouraging teachers to do so. In fact, the social pressure from students seems to be a more important factor than the one from parents (figure 9). Finally, *facilitating conditions*, seem to be in place for the proper usage of the technology in the classroom. 73% of teachers agree that the technology is complementing existing schooling materials, while 82% state that the necessary infrastructure such as electricity and internet are available in their schools (figure 10&11). Overall, the four moderating factors of the UTAUT model are favorable indicators for the overall acceptance of the Meghshala system.

6.2.Meghshala's Impact on pupils

As mentioned in the methodology, the thesis draws upon a report of Gray Matters (2017), which analyzed the impact of Meghshala's product on the performance of 461 pupils from 4th to 7th grade over the course of one year in the subjects of Math and Science. Figure 2 depicts the progress of the schools which used the services of Meghshala compared to ones that did not, both in Math and Science. In general, there has been an improvement across the board in pupils learning, however, it is also clear to see that pupils from schools using Meghshala overall showed higher rates of improvement. Only in a few grades the advancements amongst the control groups were slightly higher than amongst the treatment group, while treatment groups generally show stronger improvement. Furthermore, there was a strong reduction in the standard deviation of students' performance across all grades of the treatment groups, for both

Math and Science, as figure 3 & 4 illustrate. While these findings do shed some light on the impact of Meghshala's technology, they are not sufficient to draw upon any correlations, due to the limited one-year period in which the study was performed and the low control group size.

6.3. Meghshala's distribution

The data for the usage of the app was collected through the Meghshala app. It was then cleaned, evaluated and uploaded in a Microsoft Power BI dashboard by Augmented Understanding (2017). Before Meghshala launched its' app in the Google Playstore, the company provided tablets and projectors to teachers with pre-loaded teach kits. After Meghshala launched its app in August 2017, the number of active usage hours increased from 1,002 to 1,997 hours in February 2018. Furthermore, the application is not only being used in the state of Karnataka, which is currently the sole focus of the NGO, but also in other states across India (Augmented Understanding, 2017). This illustrates that technology has the power to quickly distribute information, regardless of the distance from its source, and replicate it with virtually no limitation.

7. Discussion & Conclusion: How is technology a medium for spreading relevant education

The usage of technology in classrooms has received growing attention from governments, NGOs and private organizations, as it holds many promises for improving pupils' education, while overcoming barriers that were previously difficult to tackle. The case-study on Meghshala has the purpose of understanding the impact that technology has on reducing the gap between urban and rural schools, by delivering relevant content to remote areas and supporting teachers in their task of educating students. India in particular is facing vast challenges with the low quality of its educational sector and if no concrete actions are taken, it is likely to waste its' demographic dividend. Through the technology acceptance model, it was possible to determine the moderating factors influencing the successful adoption of the Meghshala app, and hence find out more about its' potential of improving the learning outcomes of students on a larger scale. From the subjective evaluation of respondents, they largely seem to be in favor of the

app's capabilities and its' usefulness in the classroom (*perceived usefulness*). The app was widely considered to be a helpful tool in educating classrooms with multiple age-groups simultaneously, especially by teachers who were likely to be in larger classrooms. As mentioned before by Alcoholado, et al. (2011), technology enables students with different knowledge standings to shape their own learning path more independently from the class, thus allowing poorer students to catch up, while preventing the slowdown of better students by the rest of the class. Furthermore, teachers mainly supported the statement, that through Meghshala students were able to better understand and retain the content covered in class. This can be attributed to two problems the app manages to overcome: the restrained accessibility of relevant and high-quality learning materials in rural schools and the frequent usage of textbooks in the foreign language of English (Bandyopadhyay, n.d & Banerjee, 2017). This goes hand in hand with Alcoholado, Diaz, Tagle, Nussbaum, & Infante (2016) who found that a more interactive learning environment, facilitated by technology, resulted in higher learning outcomes of students. Additionally, a more interactive learning environment results in less dropouts as Kavishwar (2018) found; a major problem in the Indian education system. They survey clearly indicated that teachers believe Meghshala tackles this problem, by making the learning environment more interactive through its' learning activity suggestions and picture and video content.

The positive responses of the survey's participants towards the moderating factors *perceived ease of use*, *social influence* and *facilitating conditions* further encourage the possibility of a widespread adoption of the application. However, the NGO needs to make sure that their application becomes less of an effort to use in the classroom, as a few respondents criticized this factor, which hinders individuals who are less willing to adopt to a new technology. The findings of Gray Matters, which illustrate stronger improvements amongst students using Meghshala over the ones who do not, provides further support to the findings of the survey and the literature on the role of technology in the educational sector. These findings also illustrate

a decline in the standard deviation of students' test scores, hence indicating that classrooms are achieving more coherent knowledge levels through technology, again supporting the findings of Alcoholado, et al. (2011). Finally, the login data collected by the Meghshala app clearly illustrates the speed with which technology is able to spread learning materials across geographical distances, which simply would not be possible with traditional methods at the same cost. The increase in the total hours of the Meghshala app usage, as depicted by Augmented Understanding, underlines that technology enables scaling with a vast reach in a short time frame and at a low cost. The findings of the technology acceptance model and the Meghshala login data collected by Augmented Understanding underline Trucano's (2013) success factors for the fruitful adoption of technology in classrooms in rural, low-income areas. Namely, Meghshala builds upon the already widespread technology of smartphones, which people can afford and know how to use. Finally, the NGO is local and on site, allowing it to collect early learnings from its work before rolling out the app on a large scale.

In conclusion, the usage of educational technology in rural and low-income environments is still in its early stages, as technology has often been too expensive to be effective on the large scale and implemented without taking the local conditions into account. However, with the widespread usage of smartphones and improved network coverage at a lower cost in these areas; educational technology has also received more support from governments. If used properly, technology can lead to better learning outcomes at a lower cost than traditional methods. The survey and data on Meghshala's teachers clearly underline that technology can be a catalyst for change in the complex Indian educational sector, potentially at scale. Technology, has the ability to reduce the cost of learning, bring higher quality education to rural areas, support teachers and democratize access to education for all. The mission of Meghshala shows that, with the support of teachers, educational outcomes can improve and lead to a more universal attainment of education in schools across India. Despite the fact that India's education system is still facing many challenges, organizations such as Meghshala actively contribute to a more

universal and higher quality education in India. However, organizations and governments need to be cautious with their implementation and approach towards technology inside the classroom. Technology is not a miracle that will magically improve the schooling outcomes of pupils. It needs to be carefully implemented to the right context and tested for its impact before it is rolled out on a large scale. More research on the effective usage of technology in the educational sector is needed to garner more insights and further aid governments around the globe to improve their educational systems. Furthermore, better measurements need to be implemented, to make initiatives impacts more transparent and traceable, while allowing for better benchmarking of initiatives.

References

Aghion, P., Boustan, L., Hoxby, C., & Vandenbussche, J. (2009). *The Causal Impact of Education on Economic Growth: Evidence from U.S.* Boston: Harvard University.

Akash. (2016, 10 12). *The Growing Teacher Shortage in India*. Retrieved from Toppr: https://www.toppr.com/bytes/teacher-shortage-in-the-country/

Alcoholado, C., Diaz, A., Tagle, A., Nussbaum, M., & Infante, C. (2016). Comparing the use of the interpersonal computer, personal computer and pen-and-paper when solving arithmetic exercises. *British Journal of Educational Technology*, 91–105.

Alcoholado, Nussbaum, Tagle, Gomez, Denardin, Susaeta, . . . Toyama. (2011). One Mouse per Child: interpersonal computer for individual arithmetic practicejcal_438 295..309. *Journal of Computer Assisted Learning*, 295-309.

ASER. (2016). *Annual Status of Education Report (Rural).* New Delhi: ASER.

Augmented Understanding. (2017). *Meghshala Teachkit Usage*. Retrieved from Microsoft PowerBI: https://app.powerbi.com/view?r=eyJrIjoiZmFlMmE2MGEtYjNiMS00ZWE1LTgyOTAtYWQxMDkyZmY0YmU3IiwidCI6IjMzNjkwODU0LTM4OGQtNGRmMy1hNDgzLWUwZTJhNzA5OTE4ZSJ9

Bandyopadhyay, S. (n.d.). *Bridging rural-urban educational divide using social technologies*. Retrieved from Indian Institute of Management Calcutta: https://iimcal.ac.in/bridging-rural-urban-educational-divide-using-social-technologies-prof-somprakash-bandyopadhyay

Banerjee, S. (2017, 11 29). *Importance of Rural Education in India!* Retrieved from LinkedIn: https://www.linkedin.com/pulse/importance-rural-education-india-sourabh-banerjee/

Behar, A. (2017, 08 03). *The sordid tale of teacher education in India* . Retrieved from livemint: https://www.livemint.com/Opinion/mMlpr6ApjWOftrA8ktpWRP/The-sordid-tale-of-teacher-education-in-India.html

Bist, V. (2017, 07 10). *Different Educational Scenario in Schools in Rural & Urban areas* . Retrieved from Foundation of Healthcare Technologies Society: http://fhts.ac.in/different-educational-scenario-in-schools-in-rural-urban-areas/

Chowdhury, S. R. (2017, 05 30). *Interview: What is wrong with India's teacher training system and how to fix it*. Retrieved from Scroll.in: https://scroll.in/article/838958/interview-what-ails-the-teacher-training-system-and-how-to-fix-it

Coughlan, S. (2015, 09 15). *Computers 'do not improve' pupil results, says OECD*. Retrieved from BBC: https://www.bbc.com/news/business-34174796

Gray Matters. (2017). *Meghshala Impact Assessment Report - April 2017.* Gray Matters.

Hnatkovskay, V., & Lahiriy, A. (2013). *The Rural-Urban Divide in India.* London: International Growth Center.

Holden, R. J., & Karsh, B.-T. (2010). The Technology Acceptance Model: Its past and its future in health care. *Journal of Biomedical Informatics*, 159–172.

Kavishwar, A. (2018, 04 02). *Digital education among students in rural areas*. Retrieved from Forbes India: http://www.forbesindia.com/blog/education/digital-education-among-students-in-rural-areas/

Kohli, N. (2016, 04 06). *Not in the class: A story of India's missing teachers* . Retrieved from Hindustantimes: https://www.hindustantimes.com/india/not-in-the-class-a-story-of-india-s-missing-teachers/story-8HITtop9bbJbL18cGC5U7H.html

Krishna, A. (2018, 01 26). *The state of education in rural India* . Retrieved from Livemint: https://www.livemint.com/Opinion/1km3nIazOPD0JgDwqKjz8J/The-state-of-education-in-rural-India.html

Lone, Z. A. (2017). Technology in Education in Rural India. *International Journal of Engineering Science and Computing*, 13953-13955.

Malhotra, U. (2017, 10 27). *Addressing The Shortage Of Trained Teaching Staff In Rural India*. Retrieved from Franchise India: https://www.franchiseindia.com/education/Addressing-the-shortage-of-trained-teaching-staff-in-rural-India.10216

Meghshala. (2018a). *Let's raise the standard*. Retrieved from Meghshala: http://www.meghshala.com/the-challenge/

Meghshala. (2018b). *Get Trained While You Teach*. Retrieved from Meghshala: http://www.meghshala.com/mission-meghshala/

Menon, R., Nedungdi, P., & Raman, R. (2017). *Technology Enabled Teacher Training for Low-literate, Remote and Rural Multi-grade Education Centers.* Amritapuri: IEEE.

Ministry of Human Resource Development . (2018, 04 24). *School Education*. Retrieved from Department of School Education & Literacy: http://mhrd.gov.in/teacher-education-overview

NCTE. (n.d.). *National Council for Teacher Education* . Retrieved from Scholarshipsindia: https://www.scholarshipsinindia.com/national_council_for_teacher_education_NCTE.html

Parruck, R. C. (2014). *Indian School Education System An Overview.* British Council.

Pradhan, B. (2018, 02 02). *Need Faster Growth? Spend More on Educating India's Children* . Retrieved from Bloomberg: https://www.bloomberg.com/view/articles/2018-09-14/the-financial-system-is-built-to-fail

Puppala, A. (2018, 09 22). *Teachers spend only 19.1 per cent time teaching*. Retrieved from Deccan Chronicle : https://www.deccanchronicle.com/nation/current-affairs/220918/teachers-spend-only-191-per-cent-time-teaching.html

Samhita. (2016, 04 22). *The parody that is teacher education in India* . Retrieved from Forbes India: http://www.forbesindia.com/blog/business-strategy/the-parody-that-is-teacher-education-in-india/

Scholaro. (2012). *Education System in India* . Retrieved from Scholaro: https://www.scholaro.com/ed/countries/India/Education-System

Swarup, A. (2016). *EDUCATIONAL STATISTICS AT A GLANCE.* New Delhi: GOVERNMENT OF INDIA MINISTRY OF HUMAN RESOURCE DEVELOPMENT DEPARTMENT OF SCHOOL EDUCATION & LITERACY .

Target Study. (n.d.). *Rural Education in India*. Retrieved from Target Study: https://targetstudy.com/articles/rural-education-in-india.html

The Economist. (2017a, 06 08). *India has made primary education universal, but not good*. Retrieved from The Economist: https://www.economist.com/leaders/2017/06/08/india-has-made-primary-education-universal-but-not-good

The Economist. (2017b, 06 08). *Why the world's biggest school system is failing its pupils* . Retrieved from The Economist : https://www.economist.com/asia/2017/06/08/why-the-worlds-biggest-school-system-is-failing-its-pupils

Trines, S. (2018, 09 13). *Education in India*. Retrieved from World Education News + Reviews: https://wenr.wes.org/2018/09/education-in-india

Trucano, M. (2012, 03 23). *Evaluating One Laptop Per Child (OLPC) in Peru* . Retrieved from The World Bank : https://blogs.worldbank.org/edutech/olpc-peru2

Trucano, M. (2013, 08 07). *10 principles to consider when introducing ICTs into remote, low-income educational environments* . Retrieved from The World Bank: https://blogs.worldbank.org/edutech/10-principles-consider-when-introducing-icts-remote-low-income-educational-environments

Trucano, M. (2014a, 07 22). *Promising uses of technology in education in poor, rural and isolated communities around the world*. Retrieved from The World Bank: http://blogs.worldbank.org/edutech/education-technology-poor-rural

Trucano, M. (2014b, 10 03). *Promoting literacy with mobile phones in rural Papua New Guinea*. Retrieved from The World Bank: http://blogs.worldbank.org/edutech/jobs/promoting-literacy-mobile-phones-rural-papua-new-guinea

Appendix 1: Figures and Tables

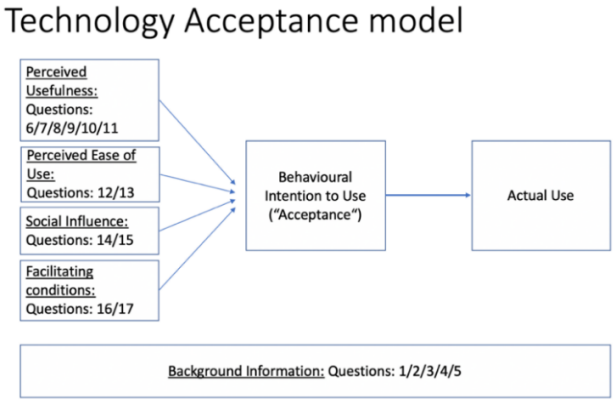


Figure 1 - Unified Theory of Acceptance and Use of Technology (UTAUT), Retrieved from: Richard J. Holden, Ben-Tzion Karsh (2009), The Technology Acceptance Model: Its past and its future in health care, Journal of Biomedical Informatics

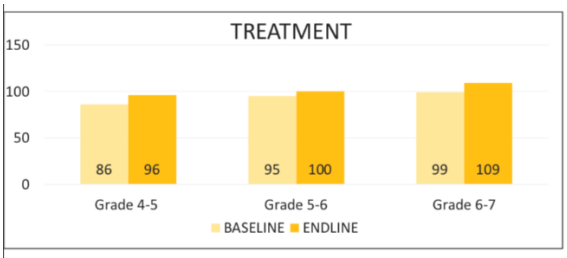
MATH

Model	Grade 4 BL	Grade 5 EL	Growth	Grade 5 BL	Grade 6 EL	Growth	Grade 6 BL	Grade 7 EL	Growth
Treatment	86	96	10	95	100	5	99	109	10
Control	90	98	8	96	102	6	99	108	9

SCIENCE

Model	Grade 4 BL	Grade 5 EL	Growth	Grade 5 BL	Grade 6 EL	Growth	Grade 6 BL	Grade 7 EL	Growth
Treatment	86	92	6	93	97	4	100	112	12
Control	87	96	9	99	100	1	102	110	8

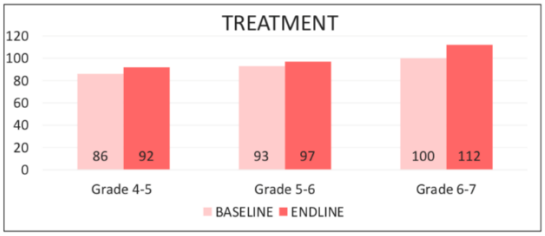
Figure 2 - Math and Science Test scores of pupils in treatment and conrol schools, Baseline vs. Endline, Retrieved from: Gray Matters (2017), Meghshala Impact Asessment Report - April 2017



School Type	Treatment Schools					
	BL	EL	BL	EL	BL	EL
	Grade 4	Grade 5	Grade 5	Grade 6	Grade 6	Grade 7
Mean	86	96	95	100	99	109
Standard Deviation	17	12	15	9	12	10
Count	55		147		173	

Figure 3 - Test results in Math of treatment schools, Retrieved from: Gray Matters (2017), Meghshala Impact Asessment Report - April 2017

LEARNING OUTCOME SCORES – SCIENCE



School Type	Treatment Schools					
	BL	EL	BL	EL	BL	EL
	4	5	5	6	6	7
Mean	86	92	93	97	100	112
Standard Deviation	17	12	15	9	12	10
Count	55		147		173	

Figure 4 - Test results in Science of treatment schools, Retrieved from: Gray Matters (2017), Meghshala Impact Asessment Report - April 2017

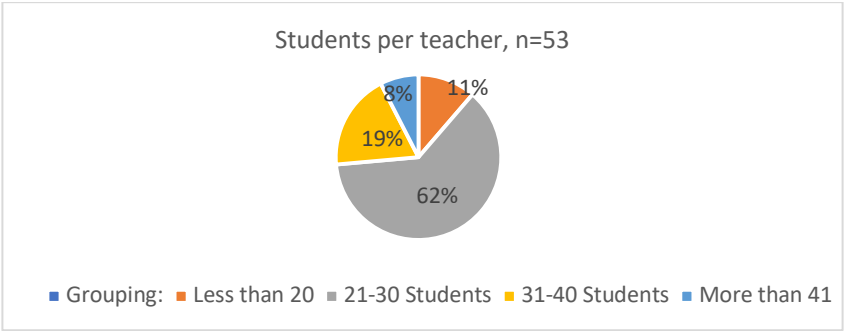


Figure 5 - Students per teacher, Survey results

Q6: IF YES, how helpful is Meghshala at educating multiple classes at once?	Count	%	Of respondents respondents with classes above 30 students
1	0	0%	0
2	5	16%	5
3	4	13%	2
4	12	38%	9
5	11	34%	8
Total	32		

Table 1 - Q6: How helpful is Meghshala at educating multiple classes at once? Survey results

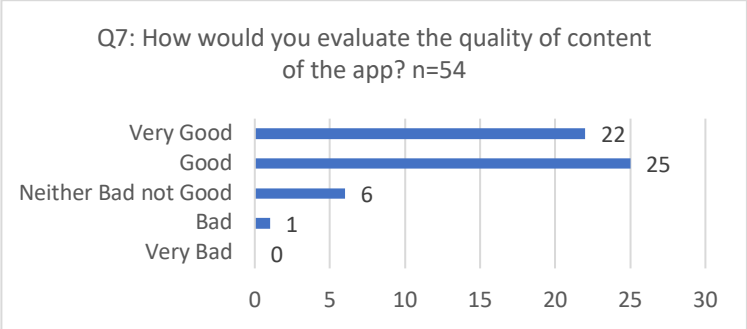


Figure 6 - Q7: How would you evaluate the quality of content of the app? Survey results

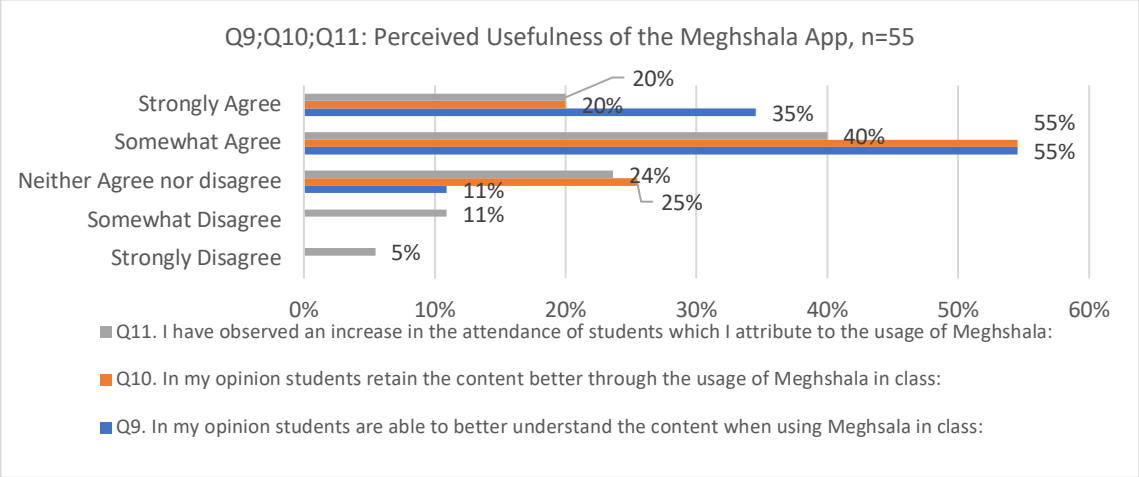


Figure 7 - Q9; Q10; Q11: Perceived Usefulness of Meghshala, Survey results

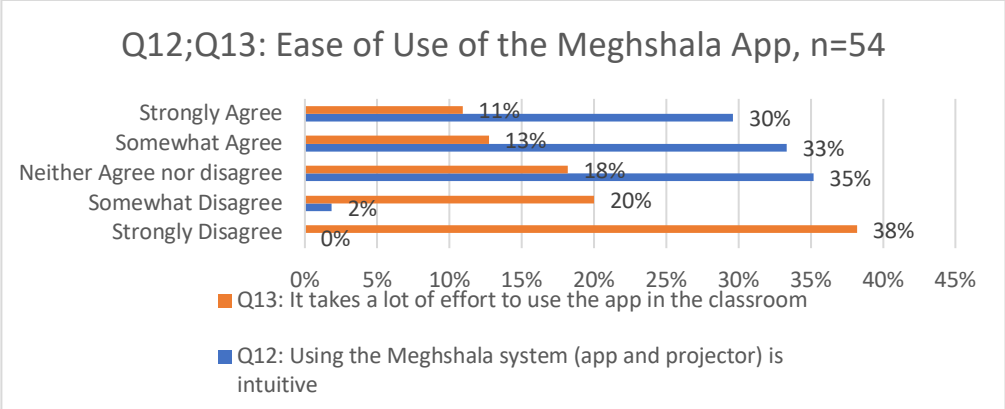


Figure 8 - Q12; Q13: Ease of Use of the Meghshala App, Survey Results

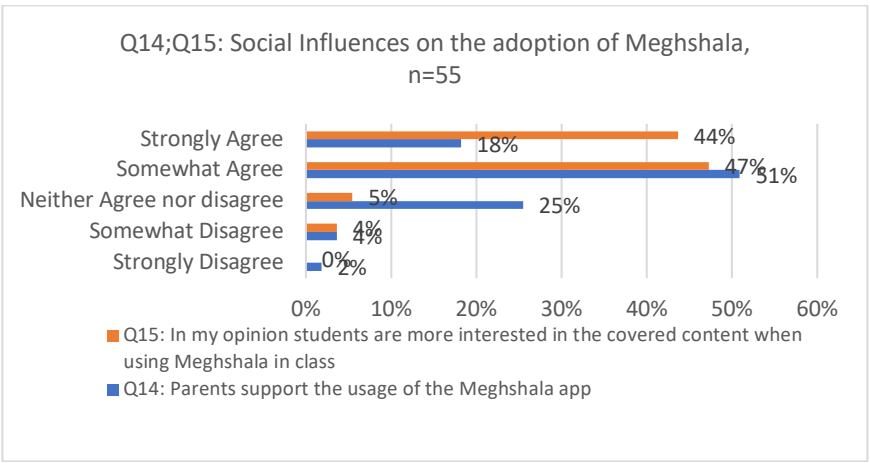


Figure 9 - Q14;Q15: Social Influences on the adoption of Meghshala, Survey Results

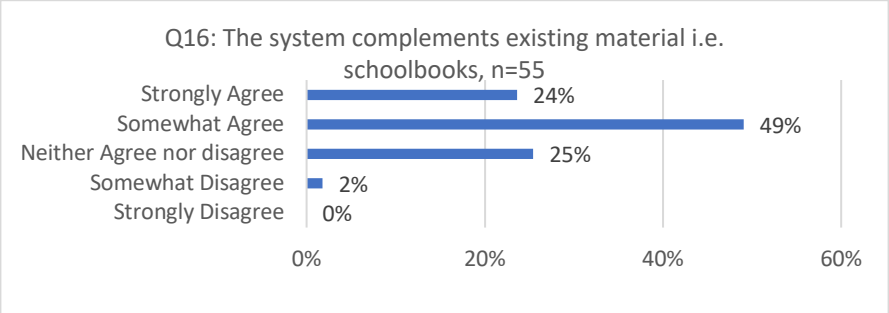


Figure 10 - Q16: Facilitating conditions, Survey Results

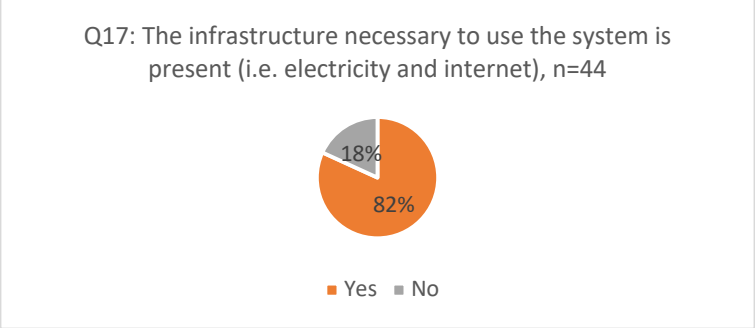
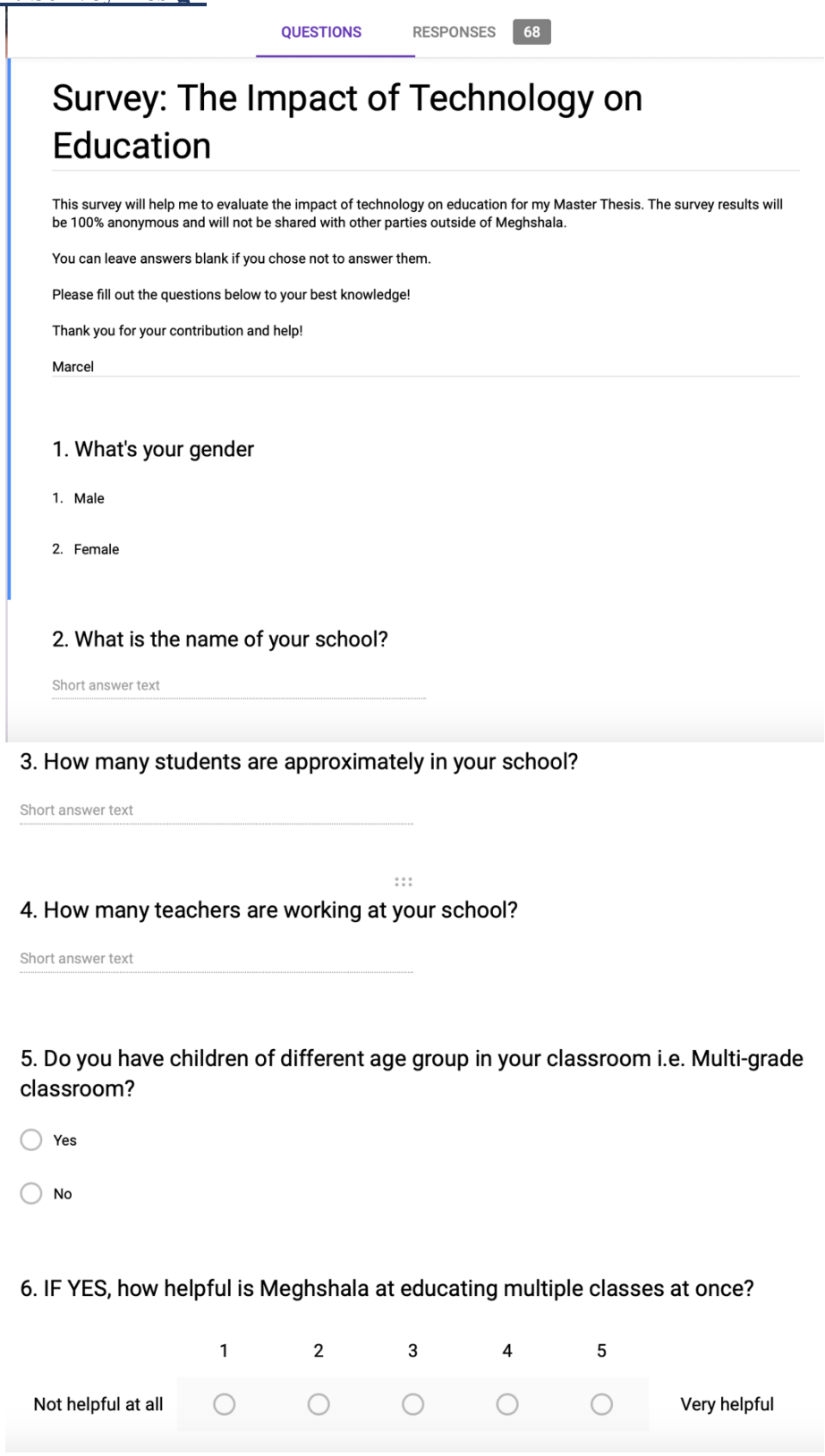


Figure 11 - Q17: Facilitating conditions, Survey Results

Appendix 2: Survey Design



QUESTIONS RESPONSES 68

Survey: The Impact of Technology on Education

This survey will help me to evaluate the impact of technology on education for my Master Thesis. The survey results will be 100% anonymous and will not be shared with other parties outside of Meghshala.

You can leave answers blank if you chose not to answer them.

Please fill out the questions below to your best knowledge!

Thank you for your contribution and help!

Marcel

1. What's your gender

1. Male
2. Female

2. What is the name of your school?

Short answer text

3. How many students are approximately in your school?

Short answer text

4. How many teachers are working at your school?

Short answer text

5. Do you have children of different age group in your classroom i.e. Multi-grade classroom?

- Yes
- No

6. IF YES, how helpful is Meghshala at educating multiple classes at once?

	1	2	3	4	5	
Not helpful at all						Very helpful

7. How would you evaluate the quality of content of the app?

	1	2	3	4	5	
Very Bad	○	○	○	○	○	Very Good

8. Is the Meghshala Teachkit helping your overall development as a teacher? (multiple answers possible)

- [ ] Yes, I have learned new things about subjects through the Meghshala teachkit
- [ ] Yes, the teachkit helps me to manage the class better
- [ ] Yes, the teachkit helps me to plan my classes better in advance
- [ ] Yes, I feel more confident giving a class using the Meghshala teachkit
- [ ] None of the above
- [ ] Other...

9. In my opinion students are able to better understand the content when using Meghsala in class:

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

10. In my opinion students retain the content better through the usage of Meghshala in class:

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

11. I have observed an increase in the attendance of students which I attribute to the usage of Meghshala:

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

12. Using the Meghshala system (app and projector) is intuitive

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

13. It takes a lot of effort to use the app in the classroom

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

14. Parents support the usage of the Meghshala app

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

15. In my opinion students are more interested in the covered content when using Meghshala in class:

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

16. The system complements existing material i.e. schoolbooks

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

17. The infrastructure necessary to use the system is present (i.e. electricity and internet)

- ○ Yes
- ○ No

18. How many hours per week do you use the Meghshala app?

- ○ less than 2 hours per week
- ○ 2-5 hours per week
- ○ 5-10 hours per week
- ○ more than 10 hours per week

Thank you for your time and participation! If you have any comments, please share them below!

Long answer text