Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh

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Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh

A thesis submitted for the partial fulfillment for the Master of Philosophy (MPhil) Degree in Education to the Institute of Education and Research, University of Dhaka

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Abstract

Utilizing technology in science classes can be crucial to actively implementing the secondary school curriculum. These days, a sizable portion of Bangladesh's secondary science education is conducted through the use of digital content combined with technology and the internet. Students' attitudes, motivations, and participation in science classes in secondary schools are significantly altered by the use of digital content. The purpose of this study was to determine what difficulties arise when using digital content in secondary science classrooms. Mixed-method research designed was followed to conduct the study. To collect data for this research, a total of 180 science teachers of secondary school and 10 teachers were selected as a sample. Quantitative data was gathered through questionnaires, while qualitative data was gathered through focus groups, interviews, and classroom observations. The quantitative data that were gathered were subjected to analysis using SPSS and MS Excel. Thematic analysis was employed to examine the qualitative data. The results of the study showed that secondary school science teachers employ digital content and technologies in their science instruction, but that their use is still subpar due to a lack of infrastructure and stakeholder perception. One goal of the new education policy is for science teachers to make their classes more interactive and student-centered, which is made possible by digital content. However, most schools still do not use a lot of technology in their science classrooms. Due to time constraints, a lack of experience integrating technology into their teaching, stringent policies from the school administration, issues with electricity, and other factors, the majority of teachers are not interested in utilizing technology in the classroom. Teachers and other stakeholders in the secondary education sector are aware of the advantages of incorporating digital content, but they are encountering a number of obstacles during the implementation phase. More time is required to get past these challenges and influence teachers' and students' behavior in order to successfully integrate digital content into science classrooms in Bangladesh's secondary education system. Some recommendations are made in light of the findings. Specifically, it is suggested that the school district provide training to secondary science teachers on the use of ICT-based resources. This will help the teachers create digital content that is compatible with ICT equipment. As a result, the learning environment in the classroom can be improved for the benefit of the students by giving the teachers the tools they need to use a practical ICT approach.

Dedication

I dedicate this thesis to my parents, husband and people who supported me along the long and tough journey.

Acknowledgement

This thesis is the product of an extensive process that involved numerous amazing individuals. Without everyone's sincere support, my accomplishment would never have happened. I have a great debt to them. Above all, I want to express my gratitude to All Mighty Allah for providing me with the fortitude, health, patience, and ultimate guidance that allowed me to finish my Master of Philosophy (MPhil) thesis.

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My heartfelt thanks should go to my husband for his care, patience, and endurance all the way through my entire study. Lastly, I would like to express my earnest gratitude and gratefulness to my parents for their encouragement and support towards my whole academic career.

Declaration

I, Sazia Sultana, declare that this study, **Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh**, is my own work. Every source I've used or cited has been properly credited with full references. The Institute of Education and Research, University of Dhaka, Bangladesh, is accepting this thesis in exchange for a Master of Philosophy in Education degree. The thesis has not been submitted in part for consideration for any other academic degree or title from any other university or organization.

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Certificate

I certify that this thesis entitled **Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh** is an original work of Sazia Sultana done under my close guidance and supervision for the award of the Degree of Master of Philosophy in Education at the Institute of Education and Research, University of Dhaka. To my best knowledge the thesis has not been submitted for any academic degree of any other universities or institutions inside and outside the country.

_____

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Acronyms and abbreviations

a2i	Access to Information
ADB	Asian Development Bank
BANBEIS	Bangladesh Bureau of Educational Information and Statistics
DSHE	Directorate of Secondary and Higher Education
GOB	Government of Bangladesh
ICT	Information and communication Technology
TQI	Teachers Quality Improvement
TTC	Teachers' Training College
UNDP	United Nations Development Program

Chapter I

Introduction

1.1 Introduction

The Information Age, which began in the early 21st century and was characterized by a swift uptake of new technologies, is what we now call the 21st century (Holland, 2015). The way we live, communicate, socialize, learn, and educate ourselves has been impacted by a number of new technologies, with information and communication technology (ICT) being the pioneer. A new global economy that is propelled by technology, fueled by information, and driven by knowledge has been created by the introduction of ICT into practically every aspect of our lives (US Department of Labor, 1999). The emergence of the knowledge economy and worldwide economic rivalry force governments to place a high priority on lifelong learning, high-quality education, and equal access to education. It is commonly acknowledged that having access to ICT in education can make people more competitive in the global economy by fostering social mobility and producing a skilled labor force (Wallet & Melgar, 2014).

For a considerable amount of time, the use of multimedia has been asserted as a crucial component in the process of both teaching and learning in the classroom. By having students refrain from creating mental images of the lesson while listening to and producing textual descriptions, the new teaching approach aims to help the students visualize the material. According to Penuel et al. (2000), multimedia-enabled teaching gives students a great deal of freedom to "organize, synthesize and develop" an engaging experience of visible contents that they perceived audibly. This ability to visualize helps students understand lessons better and retain them longer.

An essential part of Bangladesh's educational system is secondary education. Class VI is the beginning of secondary education, and class X is the conclusion. The Secondary School Certificate Exam, or SSC exam, is administered nationwide. The 2010 National Education

Policy places a strong emphasis on science education, which is why science education is important in every secondary stream.

As per the national curriculum, science is required to be studied as a common subject by students up to class VIII. Students in classes IX and X are required to select science as their major if they are in the science group. Additionally, science education is required of those who major in business and the arts. For this reason, science is an absolutely essential subject for Bangladeshi students.

The use of e-learning and digital content in Bangladeshi secondary school instruction is steadily rising. The use of e-learning and digital content in education can have a significant impact (Brent, 2005 cited in Chowdhury et. al., 2011). Science classes in secondary school mostly rely on textbooks. The science curriculum is taught to the students by the teacher using a descriptive textbook. Students typically commit the material to memory and lose it after a set amount of time. Nonetheless, teachers concur that the information is not all that memorable, and it is easily understood. Students should instead comprehend the material as well. Thus, it is crucial to present the material to the students in an engaging way. It takes time to prepare and use digital content in science classes because Bangladesh has made the use of information and communication technology (ICT) in education a high priority. Students will engage with the teacher, and it will undoubtedly assist the teacher in presenting the lesson in a visible and engaging manner.

Without the teacher and students' participation, learning cannot be properly completed. Interaction between the teacher and students makes the lesson more engaging and increases the sustainability of the learning process. A collaborative teaching and learning community can be established more easily through the use of the e-learning environment (Bates, 2005; Bonk, Wisher & Lee, 2004). The value of digital content in science classes at secondary schools has

been supported by earlier research. According to Patra et al. (2009), ICT may be essential to developing an effective e-learning infrastructure, so the government should make the required efforts to create a suitable ICT infrastructure. In order to prepare them for lifelong learning, it will enable teachers to acquire adequate subject knowledge, research teaching strategies, and pursue professional development. By exchanging knowledge with one another, e-learning allows teachers to improve their methods of instruction. Better school management and structured teaching are made possible in the classroom when ICT is used with the right support. Via appropriate training and programs pertinent to the demands of the educational system, ICT can enhance the standard of instruction and increase the effectiveness of teaching. In order to prepare them for lifelong learning, it will enable teachers to acquire adequate subject knowledge, research teaching strategies, and pursue professional development. By exchanging knowledge, teachers can improve their teaching methods with each other through e-learning. Better school management and structured teaching are made possible in the classroom when ICT is used with the right support.

The government of Bangladesh has launched various initiatives to digitize the education sector in an effort to realize the goal of creating the Digital Bangladesh. One of them is the introduction of multimedia classrooms. Multimedia classrooms have been introduced by Access to Information (a2i) at the Prime Minister's Office with assistance from USAID and UNDP. In the interim, A2i organizes workshops on digital content development and model content development by teachers for Shikkhok Batayon (www.gov.teachers portal), enabling all teachers to gather content based on subject matter. In secondary schools, there are 23000 multimedia classrooms. Additionally, the Sheikh Rasel ICT Lab, which has been established by the government in every upazilla across the nation, will be essential to running the multimedia classrooms. Additionally, roughly 61,000 teachers have received training, and a

large number of teachers continue to receive training from 500 trainers at public teacher training colleges (Mamataz, 2017).

According to Sayed et al. (2017), one of the main goals of creating a digital Bangladesh is the use of ICT in the education sector. The Bangladeshi government (GOB) has acted promptly to establish digital classrooms in all of the nation's schools in order to accomplish this goal. Additionally, they discovered that practically all teachers receive assignments from school administrators for tasks other than teaching regular classes. In this instance, teachers are unable to prepare and regularly update content for the digital classroom while in class. Teachers are also open to utilizing the digital classroom because it provides high-quality content on pertinent subjects, making it easier for students to understand the material.

When digital content is used properly in science classrooms, it can help teachers make the subjects more engaging and visually appealing. Students will also interact more with the material when it is visible to them rather than just in the text book. In order for digital content to be relevant to the content in textbooks, teachers must possess expert preparation skills. As a result, in order to prepare and implement the digital content, teachers will need training. Simultaneously, teachers must pay attention to the monitoring system from the appropriate authority in order to enhance the way they implement digital contents.

1.2 Statement of the problem

It might be more appropriate to consider technologies as complements in many situations. In these situations, technologies cannot help traditionally underserved populations unless they are combined with additional resources (Jacob, 2016). Understanding that technologies can either supplement or replace resources found in schools is crucial. They are intrinsically equalizing forces, to the extent that they are substitutes. For instance, a novice teacher who is too

overwhelmed to produce the same coherent and captivating materials that some more experienced teachers can create may find crucial support from well-designed and structured online content (Jacob, 2016).

Hydnman (2018) states that teachers face several obstacles when implementing multimedia classrooms, including appropriate access to technical support (informally in the classroom), availability of infrastructure (computer labs, software), policies (such as whether to assign digital homework), and time allotted for incorporating new technologies. Many teachers have suffered with the disruptions that devices can bring, experienced negative effects on their work, or have not used technologies effectively, even though substantial resources have been dedicated to integrating technology in the classroom. Furthermore, a lot of pre-service teachers think that incorporating new technology will be a barrier to teaching in the future (Hydnman, 2018).

Choudhury (2009) states that science education in Bangladeshi universities and schools is far from adequate. Science was once the most popular subject to study in Bangladesh at the secondary, college, and university levels. However, there has been a concerning shift in student preferences. It is rare to find qualified teachers, appropriate teaching strategies, and well-equipped classrooms and laboratories in majority of schools. The serious and deserving students are not encouraged to pursue science by the teaching style or the teachers. The result has been a steady decline in secondary and postsecondary science enrollment over the past ten years. These days, science education is becoming less valuable, superior to other subject areas, and important. Thus, it is crucial to draw students to science education by utilizing both digital content and contemporary teaching methods.

Secondary schools have begun integrating technology into their curriculum, but the use of these tools is still subpar due to a lack of infrastructure and stakeholder perception. One goal of the

new education policy was to make the classes more interactive and student-centered, which ICT helped to achieve. However, most schools still use a limited amount of technology in their teaching and learning processes.

According to sources in the Education Ministry, the government has been attempting to develop a digital classroom system as part of their plan to introduce e-learning for a number of years. The inability of some teachers to use technology, power outages, slow internet speeds, and a host of other issues prevent the development of a successful digital classroom system. Just 12% of the nation's multimedia classrooms are regularly used, according to a report published by the Directorate of Secondary and Higher Education's (DSHE) Monitoring and Evaluation Wing. In Bangladesh, no specific research has been done to identify the challenges faced by the teachers' while using multimedia or digital content in science classrooms. Therefore, this study aimed to investigate the challenges of using digital content in science classrooms by secondary school teachers in Bangladesh.

1.3 Purpose and research questions of the study

When education was viewed as a transformation of knowledge and ideas alone, teachers were in the past considered to be stiff, formal, and stereotyped. Pupils were attempting to commit all the information from textbooks and lectures to memory. As a result, the students possess insufficient comprehension of the subject. Students have fewer opportunities to demonstrate their creativity or critical thinking skills when using this method. Students have more opportunities to participate in class and to voice their opinions because modern teachers act more as guides or facilitators. ICT encourages teachers and students to have productive conversations and to use technology to further their quest for knowledge and skills (Goswami, 2014).

This study's primary goal was to investigate the difficulties associated with using digital content in the teaching and learning of science. The results will assist in enhancing student enjoyment and creating a welcoming learning environment in secondary school classrooms using multimedia. Additionally, this research will determine whether or not teachers are interested in using digital content as teaching tools. The results of this study will assist secondary educators in discussing issues that arise when utilizing digital content in the classroom.

It will also help the secondary teachers to determine the importance of developing good digital contents to improve overall satisfaction of the secondary teachers. Researchers may get inspiration to conduct further research in this area of study.

Following were the research questions for this study:

i. What extent do of the teachers use digital content in the science classroom?
ii. Why do teachers use digital contents in science classroom?
iii. What are the challenges of using digital content in science classroom teaching learning process?

1.4 Significance of the Study

If used properly, ICT can have a significant impact on extending learning opportunities for a wider range of people (Haddad & Draxler, 2002). When integrating ICT into education, pedagogy is always prioritized over technology in the teaching-learning process. It involves more than just utilizing technology and being an ICT guru—it also involves making learning more appealing, enjoyable, and participatory for the students. Students' initiation, creativity, and critical thinking are encouraged by this integration. With the use of ICT, teachers are expected to oversee students in novel, adaptable, interactive, and multimedia-based classroom activities that will enhance the learning environment (Zhu, 2003). Furthermore, Majumdar

(2015) stated that the teacher should always place the learning at the center of all activities, pedagogy should be at its core, and the integration of pedagogy and technology should be the main focus when creating any innovative teaching and learning environment using ICT.

The goal of this study is to better understand the difficulties teachers encounter when using digital content to teach science courses in the classroom. An attempt was made to determine the barriers found in the science classroom. Simultaneously, an effort was made to evaluate the difficulties associated with incorporating digital content into science education and the ways in which science instructors are implementing it in the classroom.

The study also looked into how educators and teachers perceived the value of digital content in advancing science education in Bangladesh's secondary schools. Positively, the results will provide clear understanding of the difficulties associated with integrating digital content into science classrooms and the science teaching and learning process to educators, trainers, and other relevant authorities. This will enable the concerned parties to take the appropriate steps to encourage science education among secondary school students in Bangladesh.

Students will be drawn to science education and interactive learning if the use of digital content in science classes is planned properly. The number of students will therefore rise and science teaching and learning will be more dynamic and successful if the content is presented in an appealing digital format and is implemented by qualified teachers. In any case, the results will point out the difficulties and provide solutions to guarantee that digital content is used effectively for interactive and long-term learning.

1.5 Definition of operational terms

ICT: Information and communication technologies, or ICTs for short, are technologies that facilitate information access. "ICT relates to those techniques that are used for accessing, gathering, manipulating, and presenting or communicating information," state Toomey and Ekin-Smyth (2001). The technologies may comprise software, hardware (such as computers and other devices), and connectivity (such as Internet access, local networking infrastructure, and video conferencing).

The growing convergence of computer-based, multimedia, and communications technologies, as well as the quick rate of change that defines these technologies and their application, are the most important aspects of ICT.

ICT in education: ICT in education refers to the application of various technologies as a tool to enhance the educational process and raise standards. ICT increases the use of sensors, creativity, and interactivity in teaching methods. Three categories can be used to categorize educational ICT tools: input, output, and others (related devices).

Digital Content: Utilizing technologies, mainly a computer program, to create an audio, visual, or audio-visual presentation of the subject that will be taught in the classroom. These materials foster greater communication between educators and students by offering an exclusive narration of specific lessons.

Multimedia: Multimedia, as defined by the Australian Curriculum, Assessment and Reporting Authority, is defined as materials and tools that are created or presented using digital technologies and combine two or more of the following elements: text, animation, audio, still and moving images, and images. Teachers can improve the adaptability, diversity, and accessibility of teaching and learning resources by utilizing multimedia.

Chapter II

Literature Review

Review of related literature

This chapter deals with the review of related literature, which presents the analysis of previous research findings as well as reports of published materials linked to and relevant to the research topic. In the process of reviewing related literature, an exhaustive review technique was used. First and foremost, it attempted to provide a concise review importance of digital content for science classroom. Following that, using existing and current literature, it attempted to investigate the challenges of using digital content in science classroom. Moreover, the literature review tried to clarify and expand on the barriers to use digital content in secondary science classroom. Published documents such as books, journal articles, periodicals, proceedings of conferences, PhD dissertations, and master theses were reviewed. And based on the review of related literature and its outcome, a theoretical framework was developed.

ICT is seen as a potential tool for educational change or innovation by researchers and educators worldwide (Papanastasiou & Angeli, 2008), which piqued their interest in ICT investment. Twenty-two percent of the budgets of the countries in Europe and Central Asia went toward ICT. In contrast, developing nations receive relatively small allocations (Economic, 2010). Even though there has been a noticeable shift in recent years, particularly in the use of personal computers, this does not guarantee that ICT is used appropriately in classrooms. Furthermore, a lot of nations have invested a lot of money in creating ICT integration through program development, standards modification, and the inclusion of ICT courses in teacher preparation programs (Tezci, 2009; Tondeur et al., 2007). Education reformation for that society or nation will not be feasible if current teachers are not interested in incorporating ICT into classroom practice (Tezci, 2011).

According to a study by Babu & Nath (2017), the materials' eye-catching, animated presentation of the content was the main reason why both teachers and students enjoyed using

them. The chief educators of the schools commended the computer-assisted learning resources, noting that they were created with the psychology of the child in mind. Instructors stated that these resources improved student engagement and lessened their workload when it came to delivering lessons. According to research, students' primary tasks in multimedia classrooms were to watch and listen. They did not actively participate in group and pair work or ask questions as part of their collaborative learning experiences. It appeared that educators were still having trouble utilizing these resources effectively. They occasionally found it difficult to use the materials with confidence and were unable to involve students in the activities that were recommended in them (Babu & Nath, 2017).

Numerous issues were found in the research, some of which the government also encountered. For instance, sluggish government decision-making, inconsistent power and internet connectivity, teachers' lack of confidence in utilizing multimedia materials, etc. It has been discovered that teachers' perceptions are crucial when it comes to utilizing ICT in the classroom. One of the drawbacks was that students had very little access to the resources outside of the classroom, which made it difficult for them to use the resources independently and potentially engage them in effective use (Babu & Nath, 2017).

Bangladesh's TQI-SEP Bangladesh has started a phase of its Continuous Professional Development training that aims to give secondary teachers expertise in creating digital content, in partnership with the Access to Information Project (A2I). It is hoped that this program will make ICT a valuable teaching tool for students in Bangladeshi classrooms across all subject areas. Chowdhury et.al., 2011).

According to Patra et al. (2009) (quoted in Chowdhury et al., 2011), using ICT in the classroom with the right support facilitates more organized instruction and improved school administration. With appropriate training and programs that are pertinent to the needs of the

educational system, ICT can enhance the quality of education and the effectiveness of teaching. It will enable educators to acquire the necessary subject-matter expertise, learn about pedagogy, and pursue professional growth for lifelong learning.

Since technology is being used in education and educational institutions more and more, it is critical that these institutions provide their teachers and students with the technological skills they need to function in the larger community. Technology-assisted learning is the most efficient way to acquire these skills (Albon & Trinidad, 2002; Trinidad et al., 2001 cited in Chowdhury et al., 2011).

Chowdhury et al. (2011) state that because some students were having trouble accessing the digital contents, it was advised to make them easier to use. Additionally, it was suggested that educators concentrate more on the participatory approach when utilizing digital content in the classroom as a teaching tool.

Mamataz (2017), citing the Global Grid for Learning, lists ten justifications for why teachers in the twenty-first century ought to incorporate multimedia into their lesson plans. For the following reasons, a community of learners can be facilitated and developed through online icebreaker activities; students can more easily visualize complex concepts or procedures with the use of static or dynamic multimedia; learning can be scaffolded through activities enhanced by online games and videos; and language and culture can be brought to life through the creation of audio and video instruction. Other reasons include giving students access to a "menu" of authentic assignment options that will allow them to explore and identify their interests and talents; improving accessibility by using potent multimedia software tools; facilitating the collaborative creation and discussion of concept maps that will help visualize concepts and their connections; fostering collaboration and feedback by integrating assignments with tools that support conversations and comments; making learning situated and

personal by giving students easy access to information from you and the rest of the world; and assisting students in documenting and presenting their learning through authentic assessments.

Teachers need to be well-versed in classroom pedagogy and resourceful in order to use multimedia classrooms with 100% success. The results demonstrate that the government and institutions can increase the success of multimedia instruction in secondary level classrooms by reducing the workload on teachers and offering resources and training for their research projects (Mamataz, 2017).

When it comes to the acceptance and application of new technologies in education, teachers are essential. Teachers' educational beliefs are closely linked to their actual use of ICT in the classroom (Dwyer et al., 1991), so their perceptions play a significant role in influencing their adoption of ICT in teaching and learning (Zhu, 2010). (Tondeur, Valcke, & Van Braak, 2008). The attainment of high-quality education continues to depend heavily on the caliber of teachers and their ongoing professional development (Ministry of Education GoB, 2013). In light of this, GoB routinely plans ICT training for teachers (Mamataz, 2017) (PMID, 2013). Furthermore, an official website called ShikkhokBatayon has been launched in order to facilitate the collection of subject-based materials by teachers from a single source through the implementation of Digital Content Development (Mamataz, 2017). In light of this, the purpose of this study is to assess the readiness, experience, and difficulties faced by Bangladeshi secondary school biology teachers when utilizing ICT for instruction.

The inaccuracy of social science textbooks in achieving the best possible learning outcomes is a prerequisite for the development of digital teaching materials (Lucas & Passe, 2017; Weng et al, 2018). The majority of educators believe that current textbooks are still primarily text-based, cognitive, and memory-based resources. Examples of social skills attitudes that can support students' cognitive and affective competencies, such as interacting with others,

cooperating, and problem-solving techniques, are not included in the book content. If so, it is extremely restricted (Lau et al., 2018).

Digital teaching resources are becoming a necessary tool for modern learning in the digital age (Dlouha & Pospisilova, 2018). It should be mentioned that internal factors, such as the teacher's perception, determine the primary impact of using digital teaching materials (Ertmer et al, 2012). According to a related study, technology's usefulness will affect how it is used (Ottenbreit-leftwich et al, 2010). The environment, rules, and facility support all have an impact on how different technological innovations are used in the classroom, which is related to factors affecting teachers' perceptions. An essential first step in the successful development of digital teaching materials is understanding teachers' perspectives. Positive teacher perception will contribute to the success of teaching material development, or vice versa.

According to Asadulla's (2019) findings, there is more room for students to explore texts or the presented context in vivid detail than would have been possible in a large class size. This is because lecturing in a large class cannot guarantee that every student will pay attention due to time constraints, even though every student's participation in a class lecture is necessary for a satisfactory outcome. Here, the use of multimedia in a classroom—a large classroom in a developing nation like Bangladesh—becomes validated because it positions the teacher as a facilitator, increases the likelihood of reaching every student enrolled in the class, and aids in the proper distribution of information because students' inappropriate behavior cannot interrupt a lecture using multimedia (Xu, 2017).

The teachers' institutional patronage to ensure multimedia-based instruction does not imply that the issues with conventional teaching methods—such as the lecture method, for example—have been resolved. To make multimedia classes effective and engaging, there are numerous related issues and challenges that must be overcome. Research indicates that multimedia

classes have reduced teacher workloads and made it easier to present lessons. However, Xu (2017) addressed the point that: (1) no lecture can be converted into a digital format; (2) a teacher cannot add emotion and thought-provoking material during a multimedia presentation; (3) teachers frequently lack the advanced computer skills necessary for cartoon inserts, animations, and graphics design in PowerPoint slides; and (4) a multimedia presentation can malfunction due to an electricity outage, software glitch, or other external issues that negatively impact the class.

Multimedia can be used in the classroom to quickly and accurately disseminate information, as has been demonstrated, and a large body of literature supports the practicality of these approaches. However, there are many components that must be integrated for this method to be applied and implemented in the classroom, which could make setting up a multimedia classroom difficult. A multimedia-enabled classroom environment, according to Eskicioglu & Kopec (2003), requires a few tools, such as "networked computers, storage devices, printers, scanners, LCD projectors, electronic whiteboards, digital cameras, and camcorders." These tools are used to present class lectures, texts, and information using multimedia. Therefore, it is estimable how different outside factors affect the creation of a multimedia learning environment in the classroom.

Due to the fact that humans cannot replace multimedia instruction, it has certain limitations. Zhang and Zhang (2013) investigated the flaws and shortcomings of multimedia technology in their study. They discovered that when multimedia is not transmitted properly, it can occasionally divert students' attention. They believed that multimedia management needed to be developed. Their findings demonstrated that multimedia technology is not able to function in the same way as people who can analyze information for students. "Multimedia courseware cannot replace the two-way feedback mechanism on the information between the teachers and

students; it cannot replace the knowledge inference and problem analysis by the blackboard," they concluded.

Deutscher (2009) discovered the difficulties in integrating multimedia, particularly in a science curriculum. According to Deutscher, the first issue with utilizing multimedia technology is a technical one. Technical issues can occasionally cause multimedia to start malfunctioning. Teachers become frustrated in such a situation. Once more, he discovered that the majority of educational establishments lack sufficient computer resources to accommodate every student. Furthermore, as Deutscher noted, instructors can become disinterested in utilizing multimedia in the classroom. Furthermore, Deutscher noted that the majority of educators are out of touch with multimedia technologies. They carry on using the outdated teaching resources that they created a very long time ago.

Furthermore, Hu & Xu (2012) discovered in their research the reasons behind the lack of success of multimedia, despite its apparent benefits for teachers. But he also highlighted the drawbacks of utilizing multimedia in his work. He discovered that there are not many teachers who use multimedia technology. To improve the quality of their teachers, Authority must pay a high salary. He also mentioned the infrastructure needed to set up a multimedia classroom as a challenge.

According to Patel (2013), educators may employ multimedia to such an extent that it becomes redundant for them to do anything but play the multimedia. Once more, he discovered that when students use multimedia, they occasionally don't speak well because they just listen to or watch the program. Additionally, Torres (2017) discussed the benefits and difficulties of implementing multimedia in the classroom. He discovered that creating multimedia lesson plans takes a lot of time, and that teachers are not very motivated, which could increase the likelihood that students won't pay attention. They claimed that educators who employ

multimedia in the classroom completely disregard conventional teaching techniques. Yet, Bandung et al. (2015) discovered that there are certain obstacles to the widespread adoption of multimedia-initiated learning. According to their findings, "the challenges include risk management, human resources, hardware systems, networking, application software systems, and electrical resources."

According to Sarowardy and Halder (2019), various researchers have discovered that traditional teaching methods should be combined with multimedia because utilizing multimedia alone does not foster students' creativity and critical thinking. The use of inappropriate and high-quality multimedia content by teachers is the second problem they discovered. Teachers occasionally use vibrant photos, videos, etc. Students' ability to concentrate is hampered by this. Thirdly, they stated that the fundamental idea has frequently stayed the same, with the only difference being the method from traditional to modern.

It is commonly known that instructional designs, planning, and classroom practices of teachers can be accurately predicted by their educational beliefs (Bandura, 1989; Pajares, 1992). Put another way, one of the key components of integrating ICT into the teaching-learning process is teacher training. It also helps teachers with their pedagogical problems. Infrastructure facilities, government policies on ICT literacy, computer self-efficacy, and ICT competence are some other factors that may have an impact on a change in attitude toward using ICT in the classroom. In addition to these, factors like prior teaching experience, educational attainment, professional growth, accessibility, technical support, headteacher leadership, and pressure to use ICT can all be extremely important in the implementation process (Ali et al., 2013).

Teachers and experts place a higher value on integrating ICT into the classroom in developed countries than in developing ones. Compared to developing countries, they have far more liberal adoption and usage policies. Thus, in developed countries, students are becoming more

adept at technology-based learning opportunities and doing well in the workforce (Hamidi, Meshkat, Rezaee, & Jafari, 2011). In addition, the majority of educators utilize the internet to obtain knowledge-boosting information that they can incorporate into their lessons or use to create materials and handouts for the classroom.

The majority of teachers in Ireland's post-primary schools are able to use word processing software and the internet, which is indicative of their proficiency and motivation when it comes to using ICT in the classroom. However, the teacher's comparatively low use of databases, spreadsheets, email, and graphics does not indicate that they are an expert user of these tools. Therefore, a teacher's desire to use ICT in the classroom is largely determined by how proficient they are with the specific application (Flanagan, 2008).

According to Jimoyiannis and Komis (2006), despite the fact that the majority of Greek teachers lack confidence in their ICT skills and abilities, they have positive attitudes regarding the significance of their ICT training, the role of ICT in education, and the use of ICT tools in the teaching process. Finding pertinent and helpful materials for the classroom—which can be gleaned from the internet or any other source—is the primary factor that determines teachers' confidence in their pedagogical use of ICT. The adoption of classroom practices is also impacted by teachers' ICT proficiency (Law & Chow, 2008).

One of the main obstacles to effective teaching-learning is classroom interaction. Learning cannot take place in any case if pupils do not engage and participate in class activities to a sufficient degree. An effective classroom interaction can be created by giving students opportunities to talk to each other about the classroom, providing appropriate guidance, fostering a participation-friendly environment, and boosting their level of autonomy (Burns & Myhill, 2004). Conversely, the greatest perceived benefit of utilizing ICT in the classroom to support instruction is interactivity (Beauchamp & Kennewell, 2010). Furthermore, according

to Kennewell et al. (2008), the term "interactivity" can refer to both pedagogical interactivity, which is a teaching strategy in and of itself, and technical interactivity, which uses technology to act as an interface between the user and the content.

If educators wish to guarantee the generation of innovative, sustainable knowledge, students must comprehend or become aware of the primary and creative uses of technology. When utilizing technology without the right mindset, it's likely that one will use accustomed forms and concepts. It could be a barrier to discovering new relationships and methods of production (Loveless, 2008).

ICT has ushered in a new era globally by raising the standard of education and instruction, strengthening the assessment process, and lowering the rate of student dropouts. It has smoothly transitioned the educational system from one that was teacher-centered to one that is student-centered. Students who undergo this change will be better equipped to solve problems, think more creatively, communicate more effectively, and engage in other higher order thinking activities (Trucano, 2005). Many countries reintroduced their policies on reflection on this issue (ADB, 2012), believing that this transformation would also be reflected in national educational targets.

Conversely, students become disinterested in attending classes due to the traditional, inflexible face-to-face classroom system. Dropouts from the various educational levels of the system are a result of this boredom. Richer students use private tutoring to boost their chances of doing well in school; students from relatively lower-class backgrounds are unable to afford it. ICT use in the classroom can easily focus students' attention and add excitement to the lessons (Haddad & Draxler, 2002).

The use of ICT in the classroom improves students' access, creation, and development of both technical and cognitive skills. It also increases the potential of activities that combine teaching and learning (ADB, 2009). In addition, an environment that is technology enabled guarantees the efficient exchange of information, and utilizing technology in the classroom increases its usability and accessibility (Mohd & Zainab, 2002). Additionally, integrating ICT into teaching-learning scenarios is crucial to climbing the development ladder because it can enhance a nation's human capital and students' information-using skills (ADB, 2009).

Teachers' attitudes toward ICT in education have a significant impact on ICT adoption and implementation behaviors in the classroom, according to Williams et al. (2000). Teachers generally concur that computers are an important tool, and they have high expectations for the ICT knowledge and skills that students will acquire. Frequently, they view ICT as a novel subject matter in the classroom instead of a fresh approach to instruction and the exchange of ideas between students and knowledge." Furthermore, despite their concerns about the value of ICT in education, teachers are generally not as interested in its widespread integration into lesson plans. Instructors are less convinced that ICT can enhance the educational process (Higgins, 2003).

Teachers' attitudes start to change toward making better use of ICT in their lessons as they become more involved with computers (Sang et al., 2010). In addition, a teacher's pedagogical culture influences how they demonstrate the use of ICT in the classroom (Ruthven, Hennessy, & Brindley, 2004). In most situations, teachers adopt practices that mirror their views on education (Drenoyianni & Selwood, 1998). Similar to this, integrating technology into teaching-learning activities is greatly influenced by a teacher's trust and confidence in their ability to use ICT effectively in the classroom (Sime & Priestley, 2005).

There are allegations that the use of technology forces educators to improve the effectiveness of their lesson plans. But technology by itself has no educational value. When educators effectively integrate technology into their pedagogical process, it becomes indispensable. Teachers are required to implement technology in order for it to bring innovation and development to the teaching-learning process in education (R. B. Kozma, 2003). Therefore, implementing ICT in education successfully depends on teachers' attitudes and technological readiness (Garland & Noyes, 2004; Pelgrum, 2001).

For teaching and learning to be integrated, basic computer literacy must be established. Numerous nations have also come to the realization that they must amend their policies in order to create a positive pedagogical perspective through ICT, and as a result, they are now placing a greater emphasis on teacher training (UNESCO, 2004). Before forming this government in 2021, the current ruling party in Bangladesh made public its vision of a digital nation. As a result, they placed a strong emphasis on using ICT in the classroom to raise student skill levels in line with the demands of the labor market in addition to improving educational quality. The government demonstrated its intention to rewrite its vision across the nation in 2010 when it released a new education policy (Khan et al., 2012).

Even though there are a lot of advantages to using ICT in education, teachers frequently fail to utilize all of the technology's potential because they lack the necessary ICT literacy. According to a study on teachers' ICT readiness, there is still a long way to go before schools can fully benefit from ICT use in the classroom (So & Swatman, 2006). One of the primary drivers of technology use in educational settings is the attitude and beliefs of teachers (Almusalam, 2001). The fundamental component of ICT implementation in education, according to Mumtaz (2000), is teachers' beliefs about integrating ICT in teaching-learning. In order to influence teachers' attitudes and foster belief in ICT as an instructional tool, there needs to be a conceptual

shift in the nature of learning. They will be able to ascertain the degree of their interaction with ICT and ascertain the level of student engagement with technology. In addition, educators must adopt a positive outlook when using ICT on a regular basis. This belief will enable them to acquire the necessary level of comprehension to successfully execute it. Teachers are more inclined to incorporate ICT into all facets of education when they are knowledgeable about its application in the classroom (Afshari et al., 2009).

When teachers use ICT for learning, they become more cautious when using it in the classroom. As they understand that ICT can easily lead students to real-life learning, they occasionally also believe that ICT is irrelevant in class-based instruction for encouraging cooperation and reflection in learning (Barak, 2006). Teachers are not motivated to use ICT in place of their conventional teaching methods if they do not see its benefits (Sang et al., 2010).

Tella et al. (2007) investigated the reasons behind teachers' unease and lack of confidence in integrating ICT into their lessons and discovered that "inadequate knowledge to evaluate the role of ICT in teaching and learning, lack of skills in the use of ICT equipment and software had resulted in a lack of confidence in utilizing ICT tools." Teachers' confidence has been lowered and they have avoided using technology in the classroom due to a lack of technical support and the expectation that they will make mistakes (Khan et al., 2012).

However, due to a lack of resources, some teachers are highly motivated and interested in integrating ICT into their lessons. For simple supplemental tasks, the majority of them use technology. Many educators only use computers for basic functions like word processing, spreadsheets, and grade registration (Higgins, 2003; Rosenthal, 2004). Furthermore, the vast majority of educators favor purchasing pre-made materials that are especially created for their courses. According to Chocia et al. (2010), the majority of them acknowledge that they do not have enough time to prepare digital content for every lesson.

The lack of confidence among teachers to use ICT effectively in the classroom results in inadequate use of ICT throughout the school. There exists a correlation between reduced exposure to technology and lower knowledge about computers and other related fields. Teachers who have prior ICT experience do make frequent use of technology in their lessons. According to Balanskat's (2009) research, teachers who are not proficient in using technology are compelled to cede control of the classroom; nearly half of educators consider themselves to be fairly confident in their use of ICT, such as creating presentations with text and images using PowerPoint.

According to Afshari et al. (2009), equitable access to resources for educators, students, and administrative staff, as well as the availability of hardware and software, are necessary for the efficient and successful use of technology. Most of the time, these prices are exaggerated and beyond the means of most developing nations, including Bangladesh. One of the hardest issues to solve when integrating ICT in education in a developing nation like Bangladesh is a lack of resources and inadequate infrastructure. The availability of technological tools, computer supplies, and their upkeep, including additional accessories, are necessary for the practical application of ICT (Khan et al., 2012). The correct use of ICT in education is being hampered by a few obstacles, including poor connection speed, uneven software and hardware maintenance, and lack of technical support. Teachers and education stakeholders agree that one of the biggest barriers to accessing online resources is having a bad internet connection.

ICT requires modern hardware and software, according to Gülbahar (2007). Despite being a rare occurrence in educational institutions, using modern hardware and software resources is crucial to the diffusion of technology. Installing ICT in a teaching-learning environment also requires a high-speed internet connection. However, the majority of developing nations have inadequate internet access." Although both government and private sources offer multimedia

educational resources, most Bangladeshi schools lack both qualified teachers and adequate infrastructure. According to Khan et al. (2012), there is a dearth of enthusiasm among teachers for integrating ICT into the classroom, particularly in remote regions.

School administrators emphasized how critical it is to use ICT for pedagogical approaches that may hinder students' ability to learn for the rest of their lives. School administrators occasionally gave off the impression that they were doing very little to encourage teachers to incorporate ICT into their lesson plans. Research has demonstrated that increased leadership by school administrators is positively correlated with increased ICT integration in the teaching-learning process (Pelgrum, 2008).

The abilities and expertise of educators play a major role in the success of educational innovations, according to Pelgrum (2001). One of the biggest obstacles to the use of ICT in education, in both developed and developing nations, is teachers' lack of knowledge and skills (Ihmeideh, 2009; Mamun & Tapan, 2009; Pelgrum, 2001). The usage of ICT tools in a teaching-learning environment in Bangladesh has also been restricted by a lack of understanding about ICT usage and a lack of proficiency with ICT tools and software.

For a considerable amount of time, the use of multimedia has been asserted as a crucial component in the process of both teaching and learning in the classroom. The purpose of the study was to determine the difficulties associated with using digital content in Bangladeshi secondary science classrooms. High-quality teaching resources are essential to the quality of science instruction. According to research findings (Chowdhury et al., 2011), educators feel more empowered to create engaging and pertinent digital content for their classes. Students' creativity and analytical skills are also improved, and they are inspired to learn science-related material. Previous research has shown that teachers' ignorance of technology can be an obstacle to incorporating it into the classroom (e.g. Hutchinson 2012; Koehler and Mishra 2009).

According to Mathevula and Uwizeyimana's (2014) research, common barriers to effective ICT integration in schools include inadequate infrastructure, teachers' attitudes toward ICT, ICT policy issues, and teacher training in ICT.

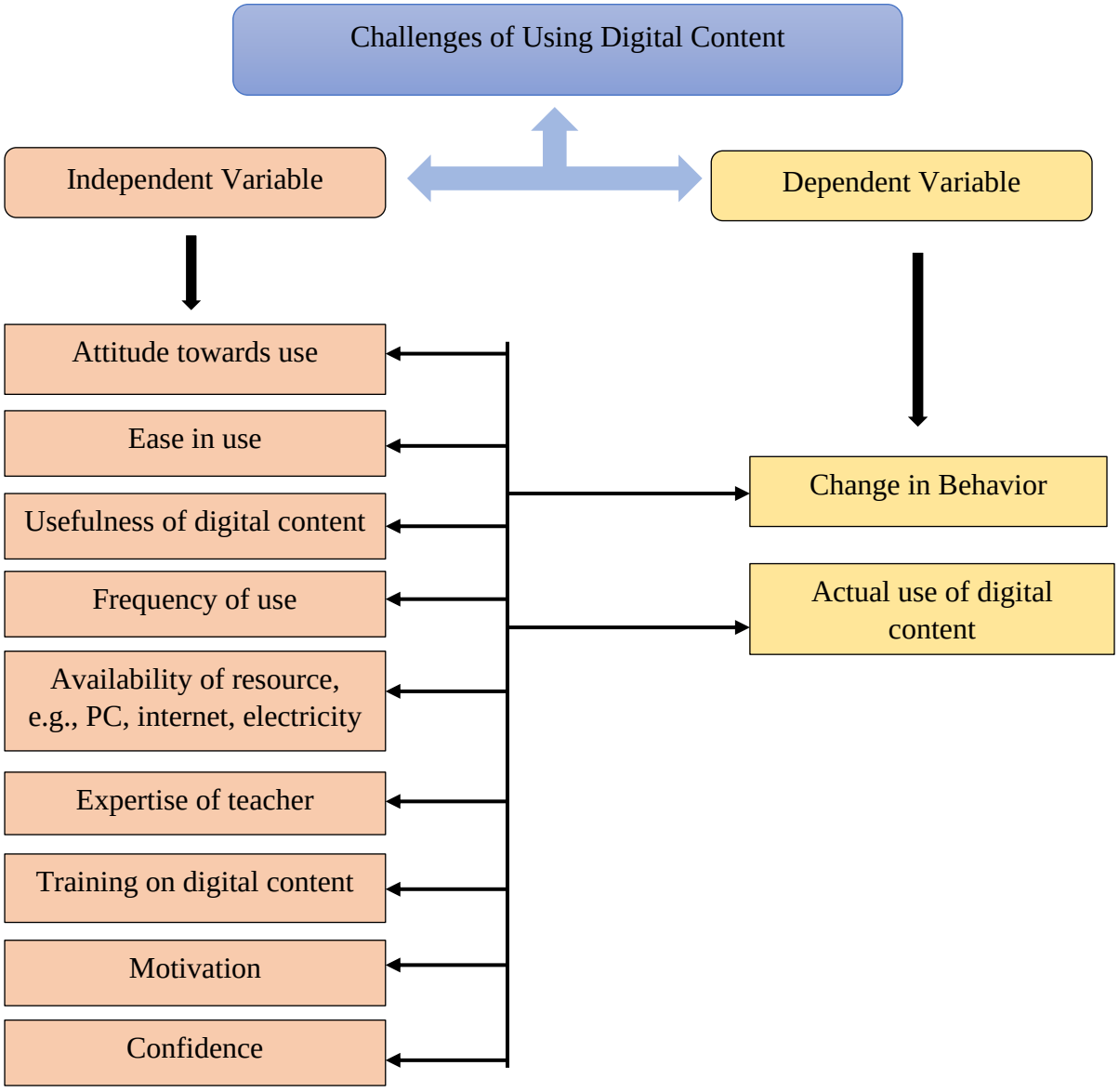

Figure 1: Theorical Framework of this study

Chapter III

Methodology

3.1 Introduction

This chapter deals with the research methods and techniques employed in this study, along with the logic behind and explanation of the selected method. The methodology of the study is described through study nature, research design, the sampling design, respondents, tools of data collection and data analysis. These are spelled out in the following sections.

3.2 Philosophical Assumptions

Since they reflect what researchers "silently think" about their work, philosophical questions are essential to the research process (Inman, 2007). Due to the close relationship between ontological and epistemological stances and the methodological approach, this philosophical understanding of the researcher entails identifying these positions. Ontological assumptions lead to epistemological assumptions, which lead to methodological considerations, according to Cohen et al. (2007). These in turn lead to problems with data collection and instrumentation. According to Cohen et al. (2007), this viewpoint causes us to refocus on understanding the world rather than research techniques as a technical exercise. This is influenced by our perceptions of the world, what constitutes understanding, and what the goals of understanding are.

Researchers who approach the social world from an objectivist or positivist perspective have access to a wide range of conventional methods like surveys, experiments, and the like, while researchers who adopt a more subjectivist or anti-positivist perspective have access to a similar array of novel and emerging techniques like participant observation, interviews, accounts, and personal constructs (Cohen et al., 2007, p. 8). While the latter is known as idiographic and is more of a qualitative approach to understanding individual behavior, the former is more of a quantitative approach defined by processes and methodologies aimed to find universal rules (Cohen et al., 2007). Because it uses convergent mixed method design (Creswell, 2014), which

integrates quantitative and qualitative approaches, this study consequently goes in both directions.

In many forms of pragmatism, knowledge claims are based on acts, situations, and consequences rather than antecedent conditions (as in post-positivism), and applications—what functions and how to solve problems—are a concern, according to Creswell (2003). Here the problem comes first, and different approaches are used by researchers to understand the problem.

In pragmatism, individual researchers have total autonomy in selecting the methodologies, according to Creswell (2003). They are "free" to choose the research techniques, plans, and procedures that best meet their needs and goals. Furthermore, pragmatic researchers think about the "what" and "how" of their work in terms of the direction they hope to take it—that is, the desired outcome.

3.3 Study nature

The study used a mixed method approach, drawing from both qualitative and quantitative research techniques. In order to answer research questions, researchers using the mixed method approach—which is well-liked in the social, behavioral, and health sciences—gather, examine, and incorporate quantitative and qualitative data in a single study or over the course of an extended, multi-year program of investigation (Creswell, cited by Porche, 2017). The study's research questions were better understood through the combined collection and analysis of both quantitative and qualitative data. A variety of tools and techniques for generating both qualitative and quantitative data were used to collect information and proof from various sources.

3.4 Research Design

Tashakkori (quoted in Mertens & McLaughlin, 2004) asserts that a researcher can obtain a more comprehensive understanding of human behavior and experiences by utilizing multiple research techniques in a study. One of the biggest advantages of mixed methods research is that it combines the best features of qualitative and quantitative research, enabling precise evaluation of attitudes and outcomes in addition to in-depth analyses of context, processes, and interactions (Lodico, Spaulding, & Voegtle, 2006; Cresswell, 2003).

The targeted samples in this study were subjected to a quantitative survey, an extensive qualitative questionnaire, and interviews. To interpret the findings, simultaneous collection and analysis of quantitative and qualitative data was done. The present investigation employed a convergent (concurrent) mixed-method design to compare the outcomes of simultaneous collection of quantitative and qualitative data for triangulation. This study combined the two methods, resulting in a mixed-method research design, to maximize the advantages of both quantitative and qualitative research while minimizing the drawbacks of each.

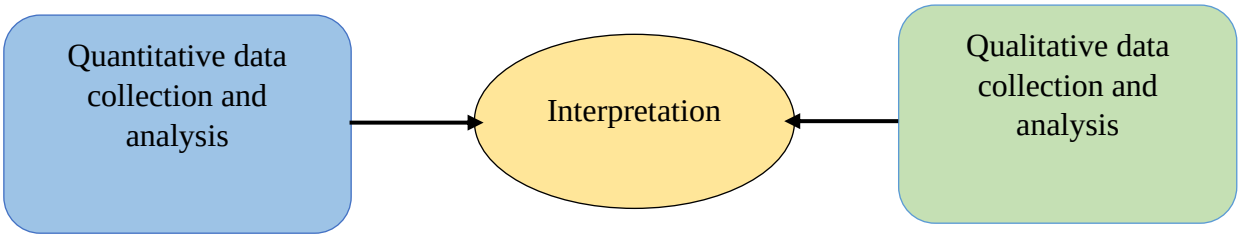

Figure 2: Research Design of this study

3.5 Sources of Data

The sources of data for this study were primary sources. The science teachers, head teachers/ assistant head teachers from secondary schools in Bangladesh, were the primary sources of

data for this study in which questionnaires and interviews were utilized in order to acquire the data from these sources.

3.6 Sample Size, and Sampling Techniques

The sample of the study was the science teachers of secondary schools. The sample also included the head teachers and assistant head teachers of the secondary school. In order to select the sample of teachers' purposive sampling technique was followed. Head teacher and/or assistant head teachers will be selected following convenience sampling.

3.6.1. Teachers

Teachers' responses about the challenges of using digital content in science teaching learning process and disclosing is very pertinent to this study. Therefore, a total 180 teachers were selected by purposive sampling technique among the teachers who received training on digital content for the relevant information. These 180 teachers were consisting both male and female teachers. An attempt was made to keep the ratio of male-female teachers as equal as possible.

3.6.2. Head teachers / assistant head teachers

A total 20 head teachers / assistant head teachers were selected by convenience sampling for collecting the data related to the challenges of using digital content in classrooms by teachers and the number of teachers using digital content in the classroom. The using pattern of digital content as a part of teaching material was explored from the response of the respondents. The following table shows the sample at a glance:

Table 1 : Respondents, sample size and selection techniques

Respondent Category	Sample size	Sample criteria	Sampling Technique	Data collection Technique
Teachers	180 (equal ratio of male and female teacher)	Science teacher of secondary level who received training on digital content	Purposive sampling	Questionnaire
Teachers	4 sessions	4 FGD sessions with teachers who received training on digital content	Convenience sampling	FGD*
Teachers (class observation)	10	10 teachers were selected by following convenience sampling for observation	Convenience sampling	Observation
Head teachers / assistant head teachers	10	10 head teachers / assistant head teachers from the secondary schools	Convenience sampling	In-depth interview

** Each FGD was consisted of 6-8 individuals with the respective group*

3.7 Instruments

Questionnaires and interviews were used to gather information with both quantitative and qualitative features. Since this was a survey study, information from the participants was gathered using interview guides and questionnaires that the researcher had created on her own. Thus, questionnaires were used to gather quantitative data, and interviews were used to gather qualitative data. These tools were appropriate for this use because the study used a mixed-method approach (Cohen et al., 2007). A triangulation technique was used to gather information and evidence to preserve the validity of the data. Three different kinds of data-generating tools were used for the study.

3.7.1 Questionnaire

The questionnaire was used to gather data because it is the most suitable way to involve a sizable sample population in a short amount of time and obtain the required information. A fundamental guideline is that, despite the wide variety of questionnaire forms, the more structured, closed, and numerical the questionnaire must be, the larger the sample size; conversely, the less structured, open, and word-based the questionnaire must be (Cohen et al.,

2007). Consequently, the investigator is presented with an assortment of questionnaire formats, spanning from extremely structured to loosely structured. Highly structured, closed-ended questions are useful because they yield response frequencies that lend themselves to statistical treatment and analysis. They also make it possible to compare various sample groups (Oppenheim, 1992). Because of the large sample size in this study, the researcher created closed-ended questionnaires based on assessment levels. For the teachers, a structured questionnaire was created. A group of respondents were tested with the ridiculous questionnaire.

3.7.2 Focus Group Discussion

A total number of 4 focus group discussion sessions were conducted with the teachers to realize the in depth understanding about the study topic. The FGDs were organized to collect responses from the participants about use digital content in the science classroom and the challenges associate with using digital content in science teaching learning process.

3.7.3 Interview schedule

To supplement the quantitative data in this study, the interview was used as the second data collection tool to get the respondents' experiences (phenomenological technique) regarding the difficulties in using digital content. Cohen et al. (2007) state that the interviews give participants or interviewees the chance to express how they view the world and share their perspectives about the environment in which they live. It was decided to conduct unstructured interviews with head teachers and/or assistant head teachers using open-ended questions. A small sample of respondents was given a draft interview schedule. The completed questionnaire was examined, and then the final draft was ready to be given to the chosen samples.

3.7.4 Observation checklist

To gain a true understanding of the difficulties associated with utilizing digital content in the classroom, the researcher created an observation checklist to record classroom activities. It was necessary to conduct the observation to see how students react to these kinds of classes and how teachers use digital content in the science teaching-learning process. The researcher had the opportunity to double check the information supplied by instructors and students through observation. To observe the teachers' use of digital content in the science classrooms, an observation checklist with open-ended observations was employed. Based on convenience sampling and teacher availability, observations were made in the classroom.

3.8 Data collection procedure

3.8.1 Quantitative Data Collection Procedure

A mixed-method approach was used in this study, specifically a concurrent mixed method. As a result, data were gathered concurrently. Along with the hard copy version of the questionnaire, participants also received an online version via Google Form, which was intended to boost the response rate. A total of 180 secondary school science teachers who had received training on the digital content were given the questionnaire.

3.8.2 Qualitative Data Collection Procedure

A few ethical issues were resolved prior to the interviews. Each of the carefully selected volunteers was contacted in person and given information about the study topic, their role in it, and the potential consequences of taking part. The researcher also made it very apparent that participation is completely voluntary, that individuals can withdraw at any time, and that they can withhold information before it is released to the public. Unstructured follow-up questions

were provided to gather more details about the problem or confirm the meanings that participants associated with certain terms and phrases.

3.9 Data analysis

Depending on the type of data collected, a concurrent mixed-method approach was used to analyze both quantitative and qualitative data. To determine whether the results of the quantitative data's statistical analysis were supported or refuted, the study used the qualitative data for triangulation. Quantitative data from the questionnaire was displayed. We examined the quantitative data from the questionnaire in terms of percentage, frequency, and other metrics.

The qualitative data obtained through observation and interview revealed various themes related to common issues in science classrooms. Each theme was then examined in detail, along with the ways in which science teachers are utilizing digital materials in the classroom. Open-ended interviews and questionnaires yielded qualitative data and evidence, which was coded and entered as numerical data. The outcomes of the quantitative and qualitative data collection processes were contrasted. To determine the difficulties associated with utilizing digital materials in science classrooms and the science teaching and learning process, an analysis was conducted.

3.10 Study Matrix

In essence, the research design matrix is a set of rows and columns that compels the researcher to consider the reasoning behind a suggested study (Charles, 2005). This ensures that all of the study's significant elements are included and that each section makes sense. Furthermore, the research design matrix serves as a prompt during the data collection phase of the study by

emphasizing the concepts that need to be defined, the variables that need to be estimated, and compelling the researcher to choose the methods to be used right away.

Science teachers, head teachers, and assistant head teachers of secondary schools were included in the study's sample in order to determine the answers to the research questions. Data were gathered in both quantitative and qualitative forms as required by the study's design. A variety of tools were used to gather the data, including an observation guideline for teachers, a FGD guideline for teachers, and interview guidelines for head and assistant head teachers. The following table shows the matrix of the study:

Table 2: Study Matrix

Research Questions	Data source	Method of Data Collection/ Instruments	Nature of Data	Data Analysis Technique
i) What extent do of the teachers use digital content in the science classroom?	- Teachers - Head/ assistant head teachers	Questionnaire for teachers Interview with head/ assistant head teacher FGD with teachers	Quantitative Data Qualitative Data	Frequencies and percentage Thematic Analysis
ii) Why do teachers use digital contents in science classroom?	- Teachers - Head/ assistant head teachers	Questionnaire for teachers Interview with head/ assistant head teacher FGD with teachers	Quantitative Data Qualitative Data	Frequencies and percentage Thematic Analysis
iii) What are the challenges of using digital content in science teaching learning process?	- Teachers - Head/ assistant head teachers	Questionnaire for teachers Interview with head/ assistant head teacher FGD with teachers Class observation	Quantitative Data Qualitative Data	Frequencies and percentage Thematic Analysis

3.11 Limitation of the study

According to Creswell (2012), limitations are any potential flaws or issues the researcher found with the study. Limitations are the methodological or design errors in a study that affect how its results are interpreted. Restrictions on materials, methods, research design, etc. can result in study limitations that affect the study's conclusions. However, researchers often hesitate to discuss the limitations of their publications because they believe that doing so would reduce the likelihood that readers and reviewers will value the study.

This research is not without limitations. A restricted number of head teachers and teachers participate in the survey and interview conducted by the researcher. Only the chosen teachers who received instruction on digital content from TTCs were included in the study's samples. Purposive sampling was employed to choose the necessary number of participants for this investigation. As a result, the study's conclusions might only apply to the group of educators who share traits with the individuals chosen for the research.

The researcher was unable to watch all the sample teachers using digital content in the science classroom due to time constraints. As a result, there were very few classroom observations made to collect data.

The bulk of the data came from the questionnaire; only a few qualitative data sources were used to support the analysis' conclusions. This study did not concentrate on a thorough qualitative examination of the variables that might have affected the difficulties in implementing digital content in science education.

3.12 Ethical Considerations

The researcher ensured confidentiality by assuring that any information participants provide will be used only for the purpose of the study, with categorization and reporting done anonymously. Other pertinent ethical considerations included explaining the study's objectives and significance to consenting respondents and encouraging their voluntary participation. Moreover, questionnaire sheets were given numbers instead of names. By obtaining informed consent and protecting the respondents' anonymity and confidentiality, the researcher ensured the high caliber and integrity of the study. The necessary data for this study was gathered in an ethical and person-sensitive manner. The confidentiality and anonymity of all the data were maintained to safeguard the identity of the participants or respondents.

Additionally, the researcher made sure that participants gave their consent to participate in the study and that the goals were made clear to them. Strict adherence to the highest ethical standards was maintained throughout the study's design, data collection, analysis, interpretation, and publication. The participants had been informed of the purpose and goal of the study. Before the FGD and interview began, the participants' consent had been requested. Respondents received assurances and guarantees that the information gathered would be handled with the utmost confidentiality and that they could withdraw from the study at any time without having to give the researcher a reason. The participants were also apprised of their entitlement to obtain access to the study's ultimate outcome.

Chapter IV

Finding of the study

4.1 Introduction

This chapter covers the analysis of both quantitative and qualitative data. The quantitative data from the questionnaire as well as the qualitative data from the study's in-depth interviews and focus group discussions were presented, analyzed, interpreted, and discussed in this section. Concurrent mixed method data analysis was used to analyze both quantitative and qualitative data. Triangulation was used in this study to ascertain whether the results of the quantitative data analysis corroborate or contradict the results of the qualitative data analysis. The study's conclusions are offered in accordance with the primary themes that the research questions require. Additionally, under each major theme, a number of sub-themes are developed to connect the various aspects and issues for improved comprehension and interpretations.

4.2 Demographic Information of the Respondents

This section contains demographic information of respondents such as respondents' gender and level of education, teaching experience, teaching level and subject of teaching. The responses to these demographic variables were presented, analyzed, and interpreted in the form of tables that comprise frequencies and percentages.

Table 3: Demographic information of the respondents

Gender	**Frequency (n)**	**Percentage (%)**
Male	90	50.0
Female	90	50.0
Education Level	**Frequency (n)**	**Percentage (%)**
Master degree	139	77.2
Bachelor degree	41	22.7
Teaching Experience	**Frequency (n)**	**Percentage (%)**
Less than 5 years	48	26.66
6-10 years	48	26.66
11-15 years	28	15.55
15+ years	56	31.11
Teaching Level	**Frequency (n)**	**Percentage (%)**
Class VI-VIII	123	68.33
Class IX-X	57	31.66

Teaching Subject	Frequency (n)	Percentage (%)
General Science	43	23.88
Physics	22	12.22
Mathematics	50	27.77
Chemistry	15	8.33
Biology	50	27.77

Out of the 180 secondary science teachers, the ratio of male and female teachers was 50% each. From the received information it was found that 77.2% teachers accomplished the Master degree before coming to teaching and the other 22.7% teachers completed Bachelor degree. Most of the participated teachers (31.11%) have teaching experience of 15+ years, and good number of teachers belong to the category of less than 5 years (26.66%) teaching career and having teaching experience between 6-10 years (26.66%). Two-third of the participated teachers teach at class VI-VII whereas one-third teach at class IX and X. The teachers participated in this study represented different subjects at secondary level including general science (23.88%), Physics (12.22%), Mathematics (27.77%), Chemistry (8.33%) and Biology (27.77%).

4.3 Use of digital content by teachers in the science classroom

Half (50%) of the participant teachers answered that they develop digital content for science classes once or twice a week. A good number (30.8%) of them responded that they develop the digital content once or twice a month. On the other hand, only 7.7% teachers develop the digital content for science classroom on daily basis. Surprisingly, a significant number (7.7%) of teachers responded that they never develop any digital content for science classroom (see table A2).

Teachers were asked about their using frequency of digital content in science classroom. According to half (50%) of the respondents, they use digital contents once or twice a week. Moreover, 34.6% teachers responded that they use digital content for science teaching one or

two time in a month. In contrast, only 7.7% teachers answered that they use digital content in science teaching learning on regular basis (see table A3).

Majority (53.8%) of the teachers replied that they use computer once or twice in a week. 19.2% teachers responded that they use computer one or two time in a month. Nevertheless, 23.1% teachers said they use computer on daily basis (see table A6).

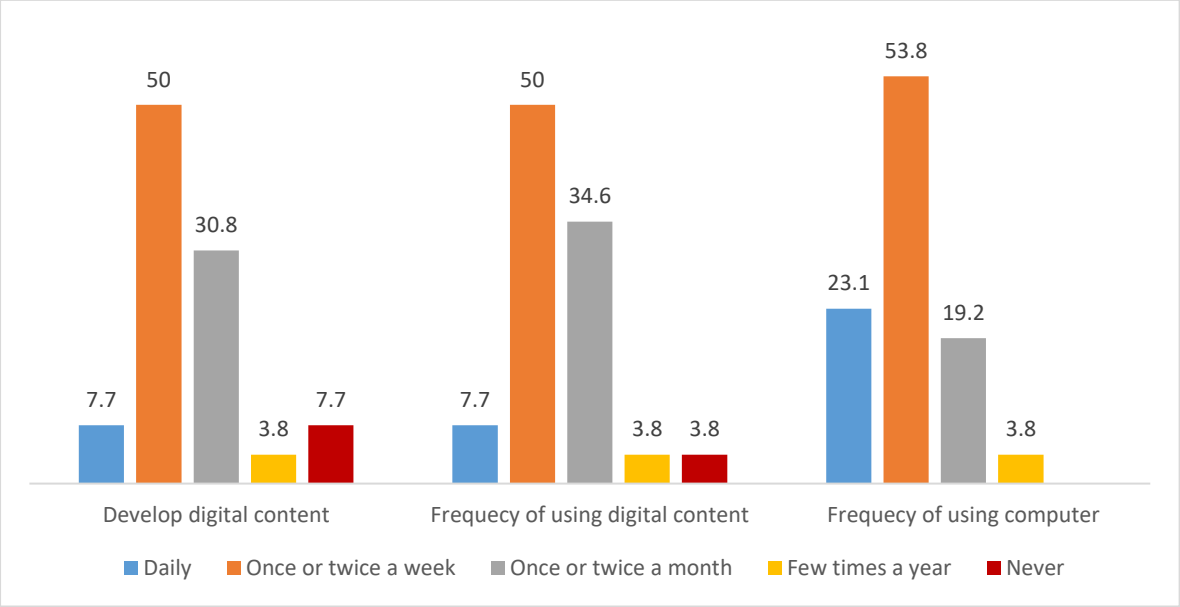

Figure 3: Usage of digital content and ICT

Most of the teachers (38.5%) use picture or photo as digital content for science classroom. Besides, 30.8% use video as digital content materials and good number (11.5%) use text as digital content for science classroom (see table A4)

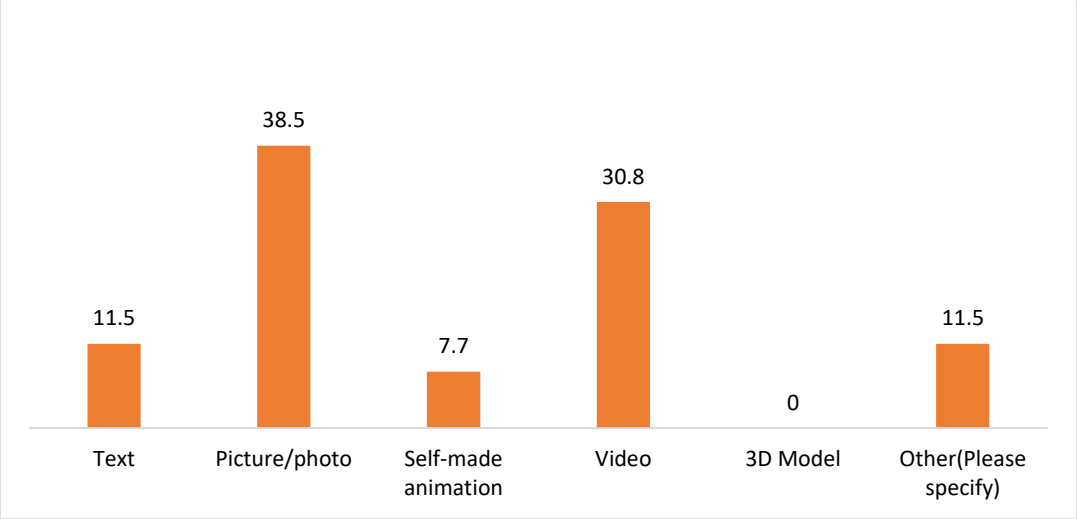

Figure 4: Nature of digital content for science teaching

All the participant teachers (100%) informed that they prefer Bangla as language to use digital content for science classroom teaching (see table A5). Majority (57.7%) teachers replied that they use the MS power point application frequently for presentation purpose. However, there were a number of teachers who download content from various web sources (15.4%) and use YouTube lecture (11.5%) on frequently. A portion (7.7%) of the teachers answered that they use web browsing frequently as a part of ICT usage (see table A7).

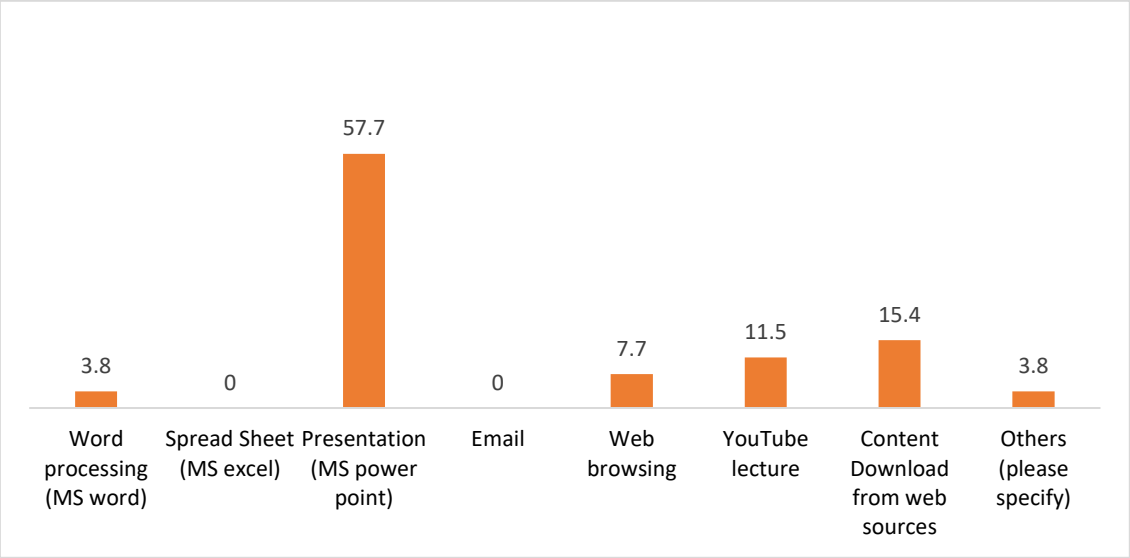

Figure 5: Usage of digital content by teacher

Half (50%) of the participant teachers informed that they use computer most of the time at school whereas 26.9% said they use computer occasionally. The number of teachers who use computer on regular basis (11.5%) and who never used computer (11.5%) are exactly same in terms of proportion (see table A10).

The frequency of using internet at school is quite impressive among the respondent teachers. According to them, 46.2% use internet on most of the time and 34.6% use internet repeatedly. There are few (19.2%) teachers who use internet at school now and then (see table A12).

Majority (46.2%) of the teachers use ICT lab at school from time to time. In contrast, a big number (34.6%) never used ICT lab at school whereas only 11.5% teachers always utilize the ICT lab at school. Nevertheless, all (100%) the teachers replied that they have access to educational materials from internet (see table A14).

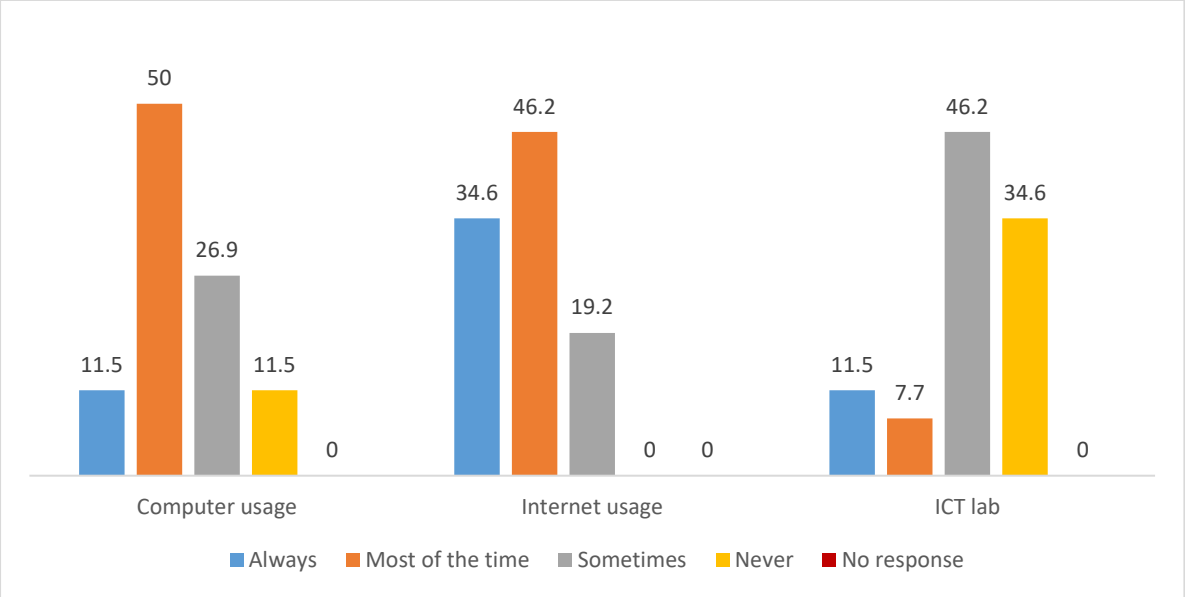

Figure 6: Usage of ICT and internet

It can be inferred from the qualitative data that science teachers employ various gadgets in the classroom to facilitate the teaching and learning process. Since science teachers have more opportunities to use various forms of technology, practically all of the teachers had focused on

using computers or multimedia in their classes. Even though every school has at least one classroom with ICT equipment and a computer lab, it is insufficient for the needs of the pupils. Furthermore, in certain schools, there is no backup electricity supply to maintain electronic devices during load shedding. Relatively few teachers are able to create content on a regular basis in addition to their regular classroom duties. However, because they are overburdened with classes each week and lack the time to create their own plans, the majority of teachers prefer to mimic or follow the ideas of others.

4.4 Reasons teachers' use digital contents in science classroom

More than half (53.8%) of the teachers replied that they use digital content to explain a concept to the students in science class. On the other hand, 38.5% said they use digital content for making presentation related to science teaching learning. There are 7.7% teachers who use digital content as a stimulator to start discussion in science class (see table A16).

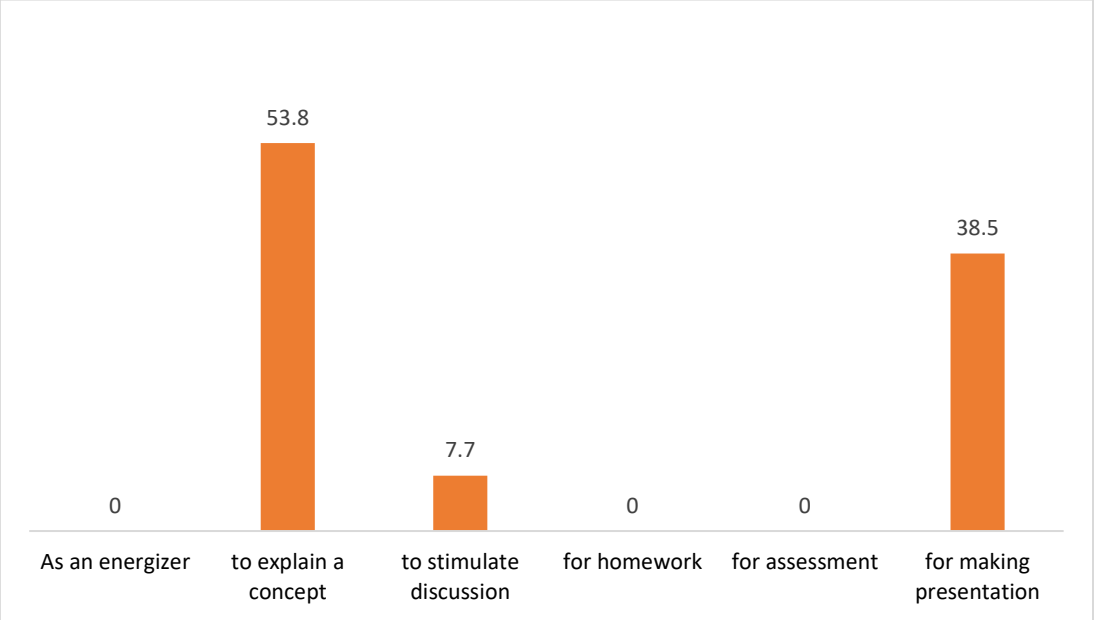

Figure 7: Purpose of using digital content

Most (42.3%) of the teachers completely agreed that digital content or digital teaching materials making science classes easy to organize. A good portion (34.6%) agreed with this

similar enquiry. However, 23.1% teachers did not agree with the fact that digital teaching materials making science classes easy to organize (see table A17).

Most (38.5%) of the teachers agreed to the query about digital content or digital teaching materials making science classes easy to design. A good percentage (30.8%%) entirely agreed with this similar enquiry. However, 26.9% teachers did not agree with the fact that digital teaching materials making science classes easy to design (see table A18)

Teachers showed their positive response either in complete agreement (30.8%) or agreement (30.8%) when they were asked about opinion regarding the more structured status of science learning through digital content. In contrast, 26.9% teachers said they do not agree with the query (see table A19).

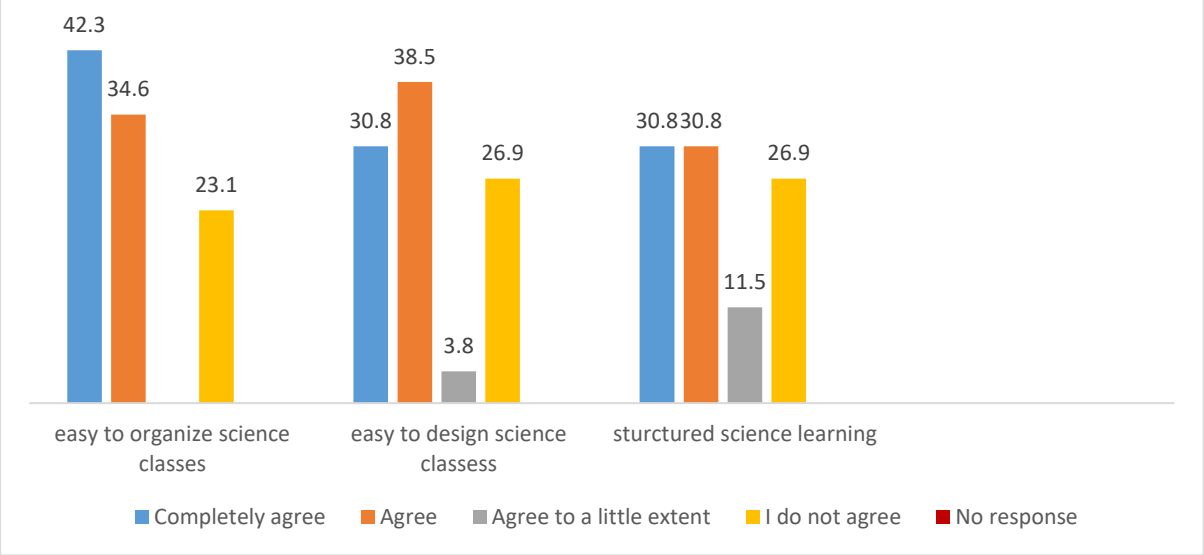

Figure 8: Perception of teacher about digital content

Almost the whole portion of the teachers either completely agreed (23.1%) or agreed (69.2%) that they use digital teaching materials as new ways to learn. There was no disagreement among the teachers in this aspect (see table A20).

Majority (76.9%) teachers agreed that they use digital contents or teaching materials in science class for improving the efficiency of learning time (see table A21). Half (50%) of the teachers agreed that they use digital contents in science class to lead students to automatic learning. Besides, 23.1% teachers agreed partially with this statement and 19.2% teachers completely agreed when they were asked the same question. However, 7.7% teachers showed their disagreement to this statement (see table A22).

Majority (73.1%) teachers agreed with the query that they use digital teaching materials in science class to facilitate the students to access to information in contrast to only 7.7% teachers who disagreed to this. Moreover, 11.5% teachers showed their highest level of agreement with this question (see table A23).

In the statement regarding the usage of digital content in science class to promote and ensure collaborative learning, no disagreement was found among the teachers. All the teachers have either completely agreed (15.4%), or agreed (73.1%), or agreed to little extent (11.5%) with this statement (see table A24).

When the participants were asked about their agreement with the statement mentioning that digital teaching materials facilitate teachers in enhancing interactive learning, 73.1% responded with positive answer. Moreover, 19.2% completely agreed and 7.7% partially agreed to this statement (see table A25).

More than 80% teachers expressed their agreement with the statement saying digital content increase students' skills in the decision-making process to solve problem. Additionally, 15.4% teachers partially agreed and however, only a small (3.8%) portion teachers disagreed to this opinion (see table A26).

Teachers expressed their agreement with the statement saying digital content is useful in supporting students' self-reliance. 26.9% teachers completely agreed, 53.8% teachers agreed and 19.2% teachers partially with this agreement. No negative responses from the teachers were recorded for this statement (see table A27).

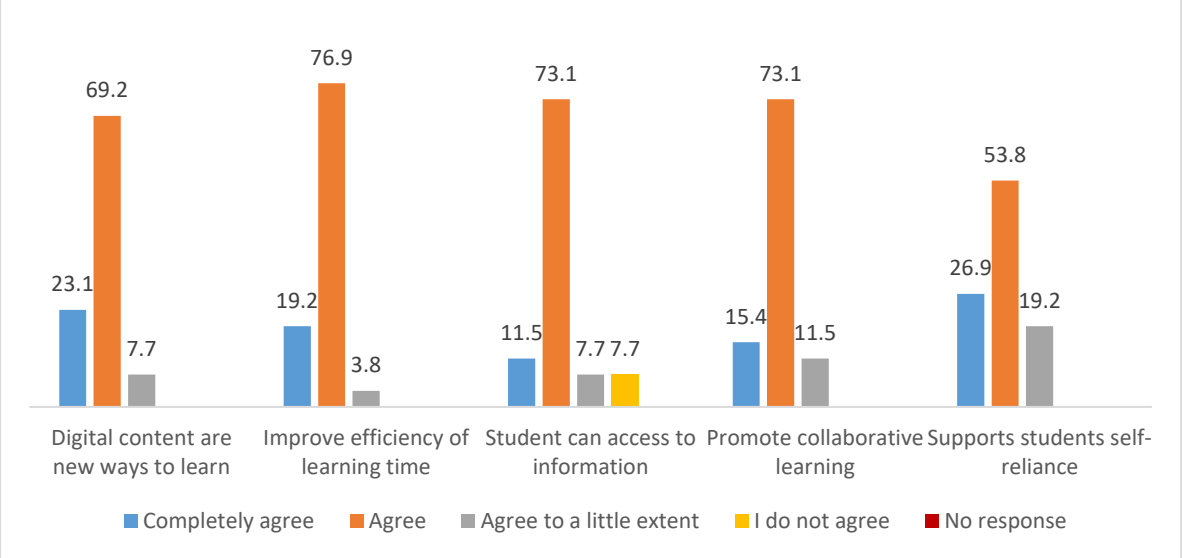

Figure 9: Reasons of using digital content in science classroom

In case of the statement concerning digital content brings learning innovation to teaching, similar to other statements, teachers expressed their positive agreement. It was recorded that a big number of teachers either completely agreed (34.6%) or agreed (46.2%) with this statement along with some limited agreement (19.2%) (see table A28).

From the response it was found that, majority (65.4%) of teachers agreed and one-fourth (26.9%) fully agreed that digital teaching materials or contents are very important as teaching materials (see table A29). Nearly all the teachers (96.1%) have either completely agreed or agreed with the statement that digital teaching materials support science teaching and learning activities more quickly. Only a small portion (3.8%) teachers partially agreed with this statement (see table A30).

In the statement regarding the usefulness of digital content as a tool for changing science learning in classroom teaching, no disagreement was found among the teachers. All the teachers have either completely agreed (23.1%) or agreed (53.8%). However, number of teachers agreed to little extent (11.5%) with this statement is also quite significant (see table A31).

Majority (53.8%) teachers agreed with the statement that digital teaching contents accelerate students' understanding for science subject. Moreover, 30.8% teachers disclosed their highest level of agreement with this statement and 15.4% teachers expressed their partial agreement (see table A32).

Teachers agreed that digital teaching materials or contents help students to understand science concepts. In this regard, high percentage of teachers have either totally agreed (23.1%) or agreed (69.2%) along with partial agreement (7.7%) (see table A33).

When the teachers were asked to demonstrate their response with the statement 'digital contents or digital materials make students more active in science teaching learning process', 76.9% teachers agreed to this. Additionally, 15.4% teachers were highly aligned with this statement whereas 7.7% teachers agreed to this to a little extent (see table A34).

It shows from the data that 61.5% teachers feel very confident, and 30.8% teachers feel confident when they use digital teaching materials for science classes. In contrast, only a small portion (3.8%) teachers answered in the opposite direction (see table A35). The response from the teachers also significantly demonstrates that they feel motivated to use digital content or multimedia for science classroom teaching. 92.3% teachers answered their agreement about feeling motivated when they use multimedia in science teaching (see table A36)

Half of the participants completely agreed and 42.3% agreed that digital content for science makes the learning process enjoyable to the students (see table A37). Most of the teachers agreed that to develop digital content for science classroom lots of time is required. In total 84.6% teachers agreed that developing digital content is time consuming and difficult. However, 15.4% teachers did not agree to this statement, and they replied it is not time taking activity and difficult (see table A38).

When asking about the less efficiency of digital content for science teaching, 58.5% teachers disagreed with that which support their agreement for the effectiveness of digital content for science classes. However, 30% teachers still agreed that digital content usage for science classes is less efficient for learning (see table A39).

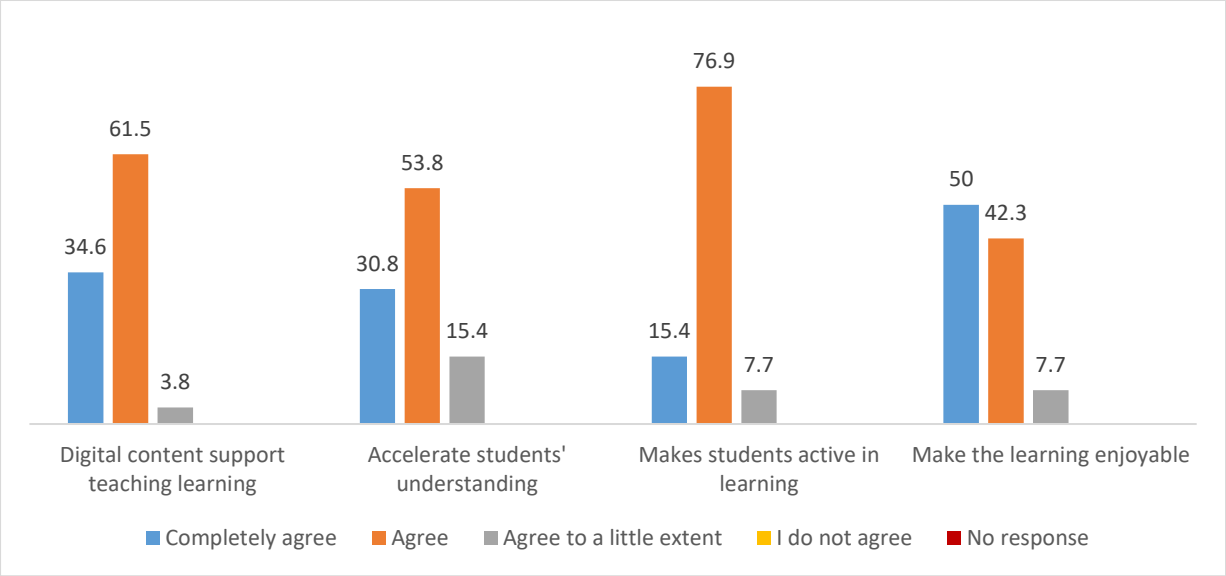

Figure 10: Reasons of using digital content in science classrooms

The qualitative information from the FGD and interviews also demonstrated the reasons behind the teachers' use of multimedia and digital content in the science classroom, as well as the advantages that come with using technology in the classroom for the benefit of both teachers and students. Positive responses to the reasons for digital content were given by all the head teachers and teachers. According to one of the teachers, using digital content in the classroom

allows students to interact directly with the material through live presentations, which is particularly helpful for science classes. According to a different teacher, it's critical for teachers of science to make abstract concepts as visible as possible to their students. Teachers also mentioned how much more engaging and appealing science classes are, which keeps students from getting bored in the classroom. It was also discovered that educators believe using technology in the classroom benefits them. Majority of the participants stated that having a technologically advanced classroom enables them to have excellent communication with students and produces amazing learning outcomes. A teacher said:

> When I use digital content and multimedia for science teaching the teaching learning process became real, joyful for the students. The use of technology and new approach of teaching support to develop the students' creativity and students seem to interact more than previous time. It also developing computer skills of the teachers and students.

Students' involvement in group studies has increased in appreciations to ICT-based teaching and learning activities. Students can now learn quickly and easily, exchange information quickly, and become more attentive. They are also more receptive to joyful, effective learning that is based on audio, video, and picture sources. Additionally, students' creativity and practical knowledge have increased. The educators asserted that ICT had simplified problem-solving, offered real-world examples through audiovisual materials, and facilitated quick information exchange.

The majority of teacher who use technology to enhance their teaching-learning process concur that students appear to be enjoying their classes more now than when they first began incorporating ICT into the classroom. In the past, majority of the students did not find their classes enjoyable, and they were generally less receptive than they are now. Their lesson is more enjoyable when they use ICT because of the engaging activities they can do in class. Pupils find it enjoyable to visualize the material, and they don't mind being disruptive in class. Students seem to enjoy using ICT in the classroom to participate in a variety of activities. When

teachers use animation or videos that are relevant to the lesson's topic, students' participation increases even more, and they appear genuinely excited about the upcoming class.

Prior to the widespread use of technology, some educators reported that they occasionally found it difficult to fully explain certain topics to their students, and that this made it harder for them to understand. They are able to quickly modify the time and content for a given period of time by displaying various science topics. These projections display the abstract material in a realistic manner, and students rapidly adjust to them. According to a biology teacher:

> Before using multimedia and digital content, I use the board to write and draw figures which takes most of the time from the class duration. Students also had to follow and write every word to understand the topic which was difficult for them. But when I stated to use digital content with the help of computer and projector to show the pictures, written presentation, or videos it took lesser time and students can follow it easily. It gives me more time to discuss with the students, and they can let me know what they understood from the topic.

4.5 Challenges of using digital content in science teaching learning process

Teachers mostly agreed that lack of technical support on hardware and software issue is problem for using digital content in science teaching learning process. Only 7.7% teachers disapproved that technical support is not a problem (see table A40).

Majority of the teachers (84.6%) answered that unexpected power failure during the class hour is a problem for using digital content in science classroom (see table A41). Teachers expressed that lack of computer in school is a problem for using digital content in science classroom and teaching learning process. 34.6% teachers completely agreed with this statement. Besides, 30.8% teachers answered in approval of this statement. In contrast, 23.1% teachers did not agree that lack of computer in school is a problem (see table A42).

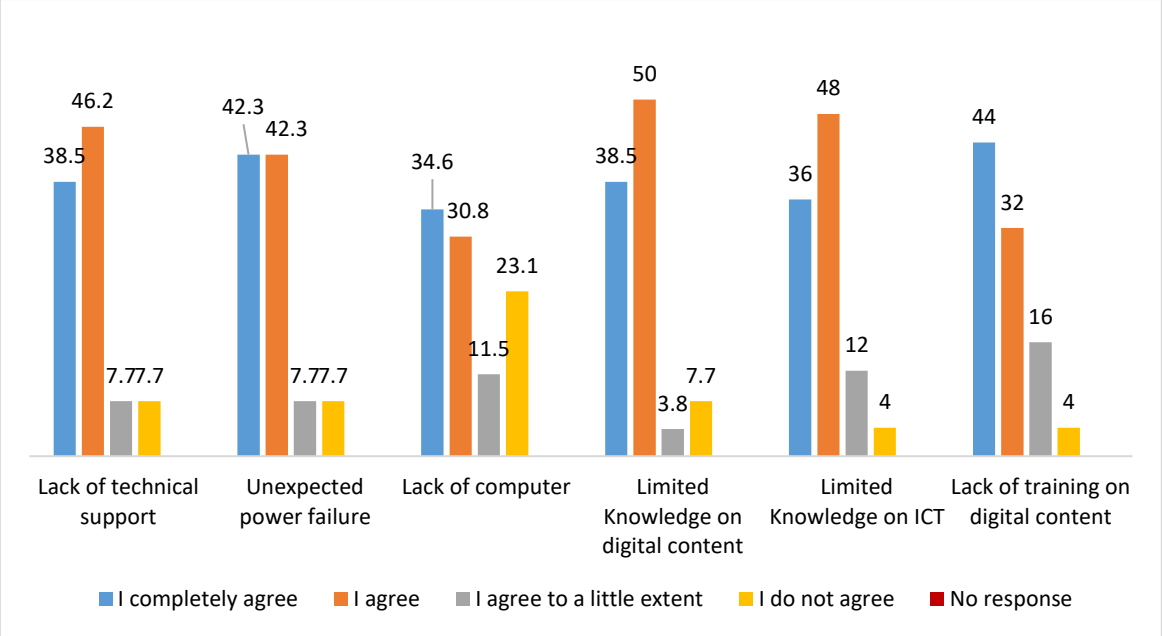

Figure 11: Challenges of using digital content in science classroom

Majority of the teachers completely agreed (38.5%) and agreed (50%) with the statement that limited knowledge on creating digital content and appropriate usage is a problem for using digital content in science classroom. However, only 7.7% teachers differed to the statement than others (see table A43).

Teachers answered that limited knowledge on ICT and challenges to use ICT is a problem for using digital content in science classroom teaching. It was recorded that 36% teachers completely agreed with this statement while other 48% teachers agreed (see table A44).

Teachers' response also goes in favor of the statement that lack of training in digital content preparation and application is a problem for using digital content in science classroom. Most of the teachers either fully agreed (44%) or agreed (32%) to this statement. However, a small portion (4%) teachers showed their disapproval to this statement (see table A45).

The following discussion provides a list of all barriers that were mentioned during the interviews or noticed during the observations. Unavailability of infrastructure, equipment and

web-based resources in the classrooms the effective integration of ICT requires the availability of equipment, infrastructure, supplies of computers and their proper maintenance including other accessories (software and hardware). The study found that all classrooms were not properly equipped. They lacked equipment such computers, projectors as well as internet connectivity.

The FGD and KIIs state that the following are typical obstacles to using digital content in science classes: teacher and student resistance, inadequate knowledge of ICT and digital media, poor management and miscommunication of ICT, insufficient school resources, and a lack of infrastructure supporting ICT, among other issues. Some participants stated that the main obstacle to properly executing digital content in science classes is a deficiency of updated devices (laptops, computers), as well as higher data pack or internet costs. In certain rural areas, there is very little internet connectivity. Majority of the educators do not favor using digital content because of this. As a result, teaching using digital content was quite difficult.

One of the main issues teachers and students encountered when using digital content in science classes, according to the participants, was sound quality. Participants and informants both stated that using digital content in the classroom requires effective ICT management. However, secondary schools in Bangladesh have extremely low ICT management and communication skills. Another issue that teachers face when implementing digital content in science classrooms is time constraints.

Majority of the teachers, in the opinion of head teachers and other educators, lack sufficient confidence when it comes to using computers, the internet, and other ICT tools. A large number of them are against using digital content in the classroom. Their confidence is undermined by a variety of issues, including buffering, bad sound quality, and bad internet connections. The Bangladeshi countryside does not have a sufficient supply of electricity. One cannot

comfortably use a computer as a result. However, the rural area's electrical supply is appallingly inadequate. Thus, the inability to obtain a steady and adequate supply of electricity is the reason why teachers don't regularly use digital content. On top of that lack of training facility for the science teachers on digital content create disinterest among them.

A sizable portion of educators asserted that they are under no obligation to incorporate digital content and ICT use into their lesson plans. Majority of the educators who are dedicated to integrating technology into their lessons are those who have received extensive training from numerous projects and who are connected to a range of ICT-related educational activities. However, majority of the teachers in every school who either never received any training or received it through their colleagues in the school compound exhibit little to no commitment to the implementation of ICT.

Additionally, some teachers claimed that other educators are not being inspired to use ICT since there is no additional compensation or recognition given to those who attempt to use digital content or ICT in their classes on a regular basis. Teachers also mentioned that creating digital content takes a lot of time, and they have to consider how best to use it. For this reason, they feel that taking classes by hand can save them more time. According to a teacher:

> If I use digital content in science class, then I need to bring laptop and the projector. Then I have to set up all technologies together for the projection in class. As we have to take almost 6-7 classes regularly, we do not get a break in between the classes. So, all the setup time goes from the class duration, and it becomes difficult to show or to discuss the full content in a single class. Moreover, creating a digital content requires a good amount of time.

One of the biggest obstacles to maintaining the caliber of instruction for secondary school teachers is the sheer number of classes they must attend each day. Although lesson plans are typically created at least a week ahead of actual class time, teachers find it challenging to produce digital content with such a full weekly schedule. In addition, teachers are required to

perform administrative tasks in the classroom. Some are responsible for planning extracurricular activities, while others are part of the examination committee. Even the parents of their students attend regular meetings with them. Another teacher said:

> I have to conduct five to six classes on average per day; sometimes it becomes seven if any teacher remains absent. The school does not give any facilities or free time for making digital content. I do not get any time during my school hours, I do it after reaching home. Sometimes it becomes midnight to develop my content for next day class.

Teachers and head teachers report that there is virtually no oversight or monitoring of the use of ICT in the classroom. Seldom are the teachers who were able to participate in various projects as a means of training observed. The principal or headmaster is expected to make frequent classroom visits and oversee the use of ICT at various school levels. Majority of the teachers concurred that their headmaster does not routinely check in on these matters, and a few said that neither the headmaster nor the school administration ever provided them with any supervision. A teacher who participated in digital content training mentioned:

> Whatever we have learned in training, we will forget it quickly if we do not practice it in our classroom activities. Most of the teachers are not interested in integrating ICT in their teaching as they think it is complex to do. But if there were regular supervision from the ministry of education teachers had to be encouraged to use technologies regularly in their teaching method.

Instructors are still not sufficiently driven to implement new, cutting-edge teaching-learning techniques in their classrooms or to use digital content. Some educators are implementing technology because they are driven to do so and because they recognize the advantages of ICT use in the classroom. However, majority of the teachers stated that very few of them are interested in utilizing ICT to improve teaching quality because their promotion or pay increase is primarily based on their teaching experience. A teacher's promotion or pay increase has no bearing on how well they perform in the classroom.

Qualitative data gathered from the observation corroborated the idea that practically all schools lack physical resources. All types of the school the researcher visited had issues with electricity, ill-equipped or disorganized classrooms, and restricted internet access. In order to obtain ready-made digital content related to their subject, teachers primarily rely on government web portals for appropriate teaching materials that can be utilized in technology-integrated classrooms. The government portal is expanding these days, so not all the topics are available yet. Because they find it difficult to understand how to use the portal, some teachers also find it difficult to search for the topic. Self-motivated teachers also depend on the internet especially on YouTube to make their content acceding to their lesson plan.

Nearly every teacher utilizing ICT in the classroom asserted that their institution lacked sufficient technical know-how. There isn't a permanent technician at the school to handle various device issues effectively. Thus, no one in the school can quickly fix problems if something goes wrong with the devices or the internet goes down. Instructors must make long-distance calls and wait for technicians to arrive to have the issues resolved.

Compared to younger teachers, majority of the senior and experienced teachers show less interest. Some more experienced educators only use ICT when they can access pre-made content on their subject via the teachers' portal. They don't seem excited to try something different with the conventional teaching-learning method.

Chapter V

Discussion

5.1 Introduction

The findings are summarized in this chapter based on the themes that the study's research question demanded. The purpose of this study was to investigate the difficulties related to the use of digital content in Bangladeshi secondary science classrooms. The study also offers recommendations for reducing the difficulties associated with utilizing digital content effectively to enhance science classroom instruction. The study's findings are examined in this chapter in the context of earlier research in the field. The following headings provide a summary of the study's main conclusions based on the presentation, analysis, and interpretation of the data:

5.2 Use of digital content by teachers in the science classroom

According to Cunska and Inga Savicka's (2012) research, learning happens outside of the classroom as well, and if a teacher can effectively lead and motivate students as well as ensure that they understand the objectives and expected outcomes, then ICT can be a valuable tool. ICT facilitates access to non-traditional information sources, increases the efficacy of self-education, fosters creativity, and realizes new forms and techniques for education. The ease and speed with which we can obtain varying quantities of information is a critical factor in the success of education. Additionally, they demonstrated how the use of ICT in the classroom can foster a sense of comfort for students, increase their motivation to learn, and facilitate collaboration among peers by making the educational process more colorful, visually appealing, and stimulating. However, utilizing ICT in the classroom necessitates that teachers possess particular abilities, such as proficiency with computers, knowledge of multimedia tools, and a significant amount of time to prepare an engaging lecture. If the instructor doesn't provide material with appropriate connections to non-traditional information sources outside of a textbook, the class starts to lose its appeal.

Instructional design, according to Dasari (2001), is a methodical, iterative set of actions intended to provide a solution for an instructional problem. Setting an instructional goal, analyzing it, identifying learning domains and learning outcomes, creating criterion-referenced test questions, and developing a clear instructional strategy are the steps in instructional design. The researcher attempted to determine how much science teachers use digital content in their lesson planning and development processes, as well as how they organize their lessons for in-class demonstrations.

The study findings revealed that majority (50%) of the teachers develop and use the digital content in science teaching learning process once or twice in a week. The types of mostly used digital content for science classrooms at secondary level includes pictures, videos and textual information related to the content the teachers are teaching. The medium of instruction and language of the digital content the teachers preferred in this aspect is Bangla. The study findings also showed that most of the teachers use computer and ICT once or twice a week and the main purpose of using the technology is to make presentation in MS power point for the lesson they are teaching. Through the findings the usage of internet at school was highlighted by the teachers. Most of the school have internet connection and ICT lab facilities, however, majority of the teachers prefer to use the facilities occasionally except few who use on regular basis.

5.3 Reasons teachers' use digital contents in science classroom

According to Tran et al. (2017), modern perspectives on science education suggest that students actively construct their knowledge through connecting, communicating, and working together with others as well as through interacting with scientific models. ICT offers scientific discussions and communication opportunities that are interactive, which foster critical thinking, allow for constructive criticism of ideas presented, improve problem-solving abilities,

and encourage ongoing self-learning (Al-Rsa'i, 2013). Using digital tools thus contributes to meaningful science learning.

Teachers believed that digital teaching materials were a technology that would facilitate teaching and learning activities more rapidly, according to Lau (2018) and Osakwe et al. (2017). Consistent with Ertmer's (2012) research, educators feel that the primary driver of students' academic success is their use of digital technology in the classroom. According to Sampaio & Almeida (2016), digital teaching resources can also help teachers and students engage more deeply, make the classroom more engaging, make better use of their time, and inspire students to work harder in their studies.

According to Schunk (2012), visual displays facilitate learning, retention, and attention. The benefits of graphics are supported by a body of research on learning and the brain. Educators who incorporate visual aids such as PowerPoint presentations, overheads, drawings, concept maps, and graphic organizers into their lessons can enhance learning by utilizing visual information processing.

Although easy access to the technology and a positive attitude toward technology in general are also important motivating factors, science teachers use digital technology because of the positive outcomes that result for their students (Dawson 2008). Additionally, science instructors incorporate technology into their lessons if the curriculum supports it and they have time to reflect on their methods (Williams et al. 2004).

The study findings showed that teachers mostly use digital content for the better understanding of science concept. Teachers believed that using digital content can help the students to comprehend the topic better. Additionally, teachers use digital content for making presentation and stimulating a discussion into the science classroom. The findings revealed the opinion of

the teachers on the reason of using digital content for the science classroom. According to the teachers' digital content has many advantages that enable them to conduct a quality science class for students. They agreed that digital contents making science classes easy to design and organize. Digital content helps the teaching learning more structured and a new way to learn science topic which improve the efficiency of learning time and lead students to automated learning or self-learning.

In the study teachers informed why they prefer to use digital content for science classroom teaching. According to the participant teachers, digital content or materials facilitates students to access to information which encourage and enhance collaborative and interactive learning. It is an innovation to science teaching in modern days and considered as a crucial part of science learning. Digital teaching materials support science teaching and learning activities more quickly and accelerate students' understanding process. As a result, majority of the teachers feel confident and motivated to use digital contents for science teaching.

The benefits of using multimedia in the classroom are huge. Text, music, video, graphics, and animations are all included in multimedia. They may be more attention-grabbing and attention-holding because they can arouse multiple senses at once. Through the promotion of effective and participatory learning and the elimination of cramming tendencies among secondary school students, multimedia classrooms, digital contents, and teacher preparation have collectively improved the overall quality of learning (Mamataz, 2017).

Teachers used computers and programs like Word, PowerPoint, and Internet browsers, according to Pringle et al. (2015). However, there were few innovations in science education that promoted inquiry-based science, and the use of software tailored to the field was rare. Online resources have been effectively used in inquiry-based science education, according to reports from other researchers (Hickey et al. 2009; Hotchkiss and Dickerson 2008). Digital

content and technology are also reportedly used by science teachers because they enable students to visualize abstract scientific concepts and give them context (Varma et al. 2008). Additionally, it has been stated that having access to digital technology in the classroom is especially important for teaching science since it gives students access to current scientific knowledge and enhances their learning (Traxler 2010).

Findings of the study also support findings from other research works and pointed out why teachers use digital content in science classroom. Multimedia and digital content instruction improves students' conceptual grasp of science and helps them reach higher levels of scientific literacy (Al-Rsa'i, 2013). Multimedia and digital content-based innovative teaching fosters inquiry-based learning, creativity, and positive attitudes toward science in students. Using digital content helps students understand how important science is to their future and how relevant it is to real-world situations (Barak et al., 2011).

5.4 Challenges of using digital content in science teaching learning process

The study's results are in line with those of Unal and Ozturk (2012), who discovered that teachers in Turkey face difficulties due to a lack of ICT resources in social studies classrooms. Research by Becta (2005) has also demonstrated that the process of integrating ICT into the teaching and learning process in the classroom is hampered by a lack of internet connectivity and situations in which connectivity is not easily available. According to Pelgrum (2001), teachers with the right knowledge and skills could be able to innovate in the education sector. In both developed and developing nations, one of the biggest obstacles to running virtual classes is teachers' lack of knowledge and expertise. Thus, the use of technological instruments in classroom learning activities has also been limited by a lack of technological knowledge and proficiency.

According to Gulbahar's (2007) research, the growth of the ICT infrastructure is encouraged by the availability of electricity. In addition, modern hardware and software are required to fully utilize the benefits of ICT. Using resources such as software and hardware that are current is essential to the diffusion of technology. Another requirement for integrating ICT into teaching and learning activities is having a fast internet connection.

According to studies (Balanskat et al. 2013; Dawson 2008; Ditzler et al. 2016; Ruthven et al. 2005), utilizing digital technology in the classroom generally has positive effects. It helps teachers provide feedback to students and facilitates report grading. Although there are documented benefits to utilizing digital technology in the classroom, some researchers have expressed doubts, contending that incorporating technology into instruction does not always enhance student learning (Cope and Kalantzis 2007).

Despite of having numerous advantages of digital contents for science classroom teaching, findings of the study found that there are some challenges too. In the study the findings revealed that lack of technical support on hardware and software is a concern for using digital content in science classes. Teachers and participants also pointed out that unexpected power failure or lack of uninterrupted electricity supply is another factor causing problem to consider and use digital materials for science classroom.

While there have been examples of successful digital technology integration in science education, there have also been examples of unsuccessful implementations (Schneider et al., 2005). In one prominent instance, science instructors ran into difficulties incorporating digital content into their lessons (Nielsen et al. 2015). Despite their enthusiasm and preparation, they found it difficult to apply technology in the real world, which made the students disengaged from the lesson and turn to surfing the web and playing games.

Most of the schools do not have multiple computers and laptops which create a problem for the teachers to use the technology integrated digital content in science classroom. In addition, teachers are not well versed and skilled in developing and creating digital content by themselves which work as a challenge to use the digital content more frequently in science classroom. Although training programs are offering for the teachers on ICT and digital content development, majority of the teachers do not have the opportunity to take part in these. Besides, the follow up training on digital content preparation is missing. In consequence, teachers have either no knowledge or limited knowledge on the usage of ICT and digital content which hinder the use of digital content in science classroom teaching.

According to Lim and Tay (2003), the manner in which tools are used matters more than their kind. To achieve the desired learning outcomes, they recommend that the various ICT tool types be used in tandem with one another, complementing one another.

Science is a very practical subject that involves "doing things," according to Wellington (2004). It includes observing, quantifying, expressing and debating, testing, examining, manipulating, observing and tracking, and documenting outcomes (Wellington, 2004). But science is also a theoretical field in addition to being a practical one (Wellington, 2004). According to Wellington (2004), it entails using critical thinking as well as inference, hypothesizing, theorizing, simulating, and modeling. It also includes abstract concepts, challenging notions, and theoretical things that are invisible or incomprehensible (Wellington, 2004). The conversation that follows centers on the ways in which digital tools support learning science in both theoretical and practical domains.

Chapter VI

Conclusion and Recommendation

Conclusion

The incorporation of digital tools into science education fosters critical thinking and improves students' ability to reason, allowing them to apply newly acquired knowledge to expand upon and occasionally even question previously acquired knowledge (Hennessy, 2006). This enhances science learning by helping students to develop accurate scientific concepts and dispel myths.

To keep more science students in secondary education, the government has implemented several initiatives. Using ICT in the classroom is one of the main steps toward modernizing the learning environment. Priority is also given to setting up a digital classroom with multimedia tools, providing content development training for teachers, and allowing them to use laptop projectors in the classroom. But the full potential of the digital classroom has not yet been realized.

Encouraging students to use technology in secondary science classes has wider ramifications. In science classrooms, the appropriate use of technology by knowledgeable and skilled teachers can significantly enhance and broaden student learning. Research has indicated that the incorporation of technology and the internet into science instruction enhances student learning. Students become more engaged in the classroom and interactive activities are encouraged. Moreover, it provides students with an open learning environment and enhances their understanding of material beyond course books.

Recommendation

Based on the emerged findings of this study the following recommendations regarding the direction for further research and policy implementation have been made:

- Teachers who are not digitally literate find it difficult to use digital teaching resources, which interferes with the learning process. They are not proficient in the setup and operation of edtech tools. They also have trouble using and comprehending the features of these tools. Teachers who are not digitally literate may find it difficult to address technical issues in a timely manner, which may make them reluctant to incorporate technology into the classroom. Reducing teachers' resistance to educational technology can be achieved in two ways: first, by designing user interfaces that are easy to use; second, by providing tailored training programs tailored to the individual needs of teachers with varying degrees of digital literacy.
- Teachers resist using ICT in the classroom because they receive insufficient training and support. Teachers are more likely to put off using educational technology if they aren't given the proper training in its use. It's important to realize that different teachers may have different skill sets. Therefore, it is imperative that training materials be created with the unique needs of teachers in mind.
- Majority of the science instructors who incorporate technology and digital content into their classes have received training in this area. To use this technology in the teaching-learning process in science classrooms daily, however, it is imperative that all science teachers receive the required training. In this sense, the authorities could take the initiative to train the teachers, and those teachers could then help others enhance their ability to use ICT and digital teaching resources in the classroom.
- Teachers' ought to view the use of ICT in the classroom favorably. School administrators should take the initiative and support teachers in utilizing technology on a regular basis to foster a positive attitude toward technology and the successful integration of ICT in the classroom. Encouraging the use of digital content in the

classroom requires oversight, mentoring, and supervision. Teachers' capacity would be fostered by mentoring as well as their effective use.

- The prerequisites for technology-based teaching and learning activities at the secondary level are the required facilities. As a result, all secondary schools need to have infrastructure, particularly a computer/ICT lab, electricity, and an alternate power source. In addition, each classroom must have a projector, white board, multimedia, internet, and a laptop or computer to ensure interactive learning.
- Additional training would be required for the trained teachers to gain new information and abilities regarding contemporary ICT devices and how to use them to enhance classroom interaction. As a result, to provide certified science teachers with the most recent knowledge and ICT usage techniques, it is necessary to schedule refresher training.
- Teachers' busy schedules prevent them from creating digital materials for the classroom on their own. They are eager to use third-party content, though. Creating digital content requires a lot of work and requires a variety of skills, including user experience with various software programs, graphics, animation, and content design. In addition to teaching, teachers have a lot of other responsibilities. It is really challenging for a teacher to manage his time to create content, teach in the classroom, and lead a normal life. Teachers may participate in the content development process as co-designers, but third parties with subject-matter expertise should be the ones creating digital content.
- The out-of-date and unnecessary digital learning material is another issue faced in educational technology. Teachers are thus discouraged from utilizing technology in the classroom. They are put under needless strain because they can't provide high-quality instruction without consulting textbooks. Therefore, it is critical to periodically update the digital learning materials.

References

Abdullahi, H. (2014). The role of ICT in teaching science education in schools. *International Letters of Social and Humanistic Sciences, 19,* 217–223.

Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2009). Factors affecting teachers' use of information and communication technology. *International Journal of Instruction, 2*(1), 77-104.

Ahsan, M. T., Sharma, U., & Deppeler, J. (2011). Beliefs of pre-service teacher education institutional heads about inclusive education in Bangladesh. *Bangladesh Education Journal, 10*(1), 9-29.

Al-Rsa'i, M. S. (2013). Promoting scientific literacy by using ICT in science teaching. *International Education Studies, 6*(9), 175–186.

Almusalam, S. M. (2001). Factors related to the use of computer technologies for professional tasks by business and administration teachers at Saudi technical colleges. (Doctoral Dissertation, the Ohio State University, 2001).

Asadullah, M. (2019). *Class Size and Student Achievement in Developing Countries: Evidence from Bangladesh*. https://www.researchgate.net/publication/228858655

Babu, R & Nath, S. (2017). Use of ICT in Secondary Education in Bangladesh: Policies and Practices. https://www.researchgate.net/publication/321026266

Badia, A., & Marta, G. (2016). Exploring the use of educational technology in primary education: teachers' perception of mobile technology learning impacts and applications' use in the classroom. Computers in Human Behavior, 21–28.

Balanskat, A., Bannister, D., Hertz, B., Sigillò, E., Vourikari, R., Kampylis, P., & Punie, Y. (2013). Overview and analysis of 1:1 learning initivatives in Europe. JRC Scientific and Policy Reports.

Balanskat, A. (2009). Study of the impact of technology in primary schools. Synthesis Report.

Balanskat, A., Blamire, R., & Kefala, S. (2006). The ICT impact report: a review of studies of ICT impact on schools in Europe. Brussels: European Schoolnet.

Bandung, Y., Gani, A. M., Tanuwidjaja, H. C., & Sembiring, J. (2015). The Challenges of Delivering Multimedia-Based Learning Services in Rural Areas. In 2015 International Conference on Information Technology Systems and Innovation (pp. 1-6). Piscataway, NJ: IEEE. https://doi.org/10.1109/ICITSI.2015.7437701

Bannon, B. W. O., & Thomas, K. (2014). Teacher perceptions of using mobile phones in the classroom: Age matters! Computers & Education, 15–25.

Barak, M. (2006). Instructional principles for fostering learning with ICT: teachers' perspectives as learners and instructors. Education and information Technologies, 11(2), 121-135.

Best, John W. and J. V. Kahn. (1996): Research in Education. New Delhi: Prentice Hall of India Privet Limited.

Beauchamp, G., & Kennewell, S. (2010). Interactivity in the classroom and its impact on learning. Computers & Education, 54(3), 759-766.

Blunch, N. H., & Das, M. B. (2015). Changing Norms about Gender Inequality in Education: Evidence from Bangladesh. Demographic Research, 32, 183-218.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101.

Brian, A. J. (2016). The opportunities and challenges of digital learning. https://www.brookings.edu/research/the-opportunities-and-challenges-of-digital-learning/

Burns, C., & Myhill, D. (2004). Interactive or inactive? A consideration of the nature of interaction innwhole class teaching. Cambridge Journal of Education, 34(1), 35-49.

Creswell, J. W. (2012). Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research (4th ed.). Boston, MA: Pearson Education Inc.

Creswell, J. W. (2014). Research design: qualitative, quantitative, and mixed methods approach (4th ed.). Thousand Oaks, California: SAGE Publications.

Choudhury, S. K. (2009, April). Problems and prospects of science education in Bangladesh. In *AIP conference Proceedings* (Vol. 1119, No. 1, pp. 83-84). American Institute of Physics.

Chowdhury, M. D., Al-Mahmood, A., Bashar, M. A., & Ahmed, J. U. (2011). Localization of Digital Content for Use in Secondary Schools of Bangladesh. *Online Submission*.

Deutscher, R. (2009). Challenges Using Multimedia Integrated within a Science Curriculum Using a Classroom-Centered Design Approach.
https://www.deltaeducation.com/resources/blog/sep-2009/challenges-using-multimedia

Duhaney, D. C. (2001). Teacher education: Preparing teachers to integrate technology. International Journal of Instructional Media, 28(1), 23-30.

Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1991). Changes in teachers' beliefs and practices in technology rich classrooms. Educational Technology, 48(8), 45-52.

Farhana, Z& Chowdhury, S. (2019). Use of ICT by Biology Teachers in the Secondary Schools: Bangladesh Perspective. https://www.researchgate.net/publication/330740710

Gay, L. R. (1996): Educational Research: Competencies for Analysis and Application. New Jersey: Prentice Hall Inc.

Gulbahar, Y. (2007). Technology planning: A roadmap to successful technology integration in schools. Computers & Education, 49(4), 943-956.

Gupta, M. M. (2015). Attitude of Prospective Teachers towards the Use of Information and Communication Technology (ICT) in Teacher Education. International Journal of Scientific Research Engineering & Technology (IJSRET), 117-121.

Harris, J. B., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types. Journal of Research on Technology in Education, 41(4), 393–416.

Hennessy, S. (2006). Integrating technology into teaching and learning of school science: A situated perspective on pedagogical issues in research. *Studies in Science Education*, *42*, 1–48.

Hutchinson, A. (2012). Literacy teachers' perceptions of professional development that increases integration of technology into literacy instruction. Technology, Pedagogy and Education, 21(1), 37–56.

Iqbal Imon, M. M. (2017). *ICT integration in Secondary Education in Bangladesh: A study of Policy and Practice.* Master's thesis, University of Oslo.

Joebagio, H., & Akhyar, M. (2018). Teachers' perception on digital teaching material development in social science education. *Journal of Turkish Science Education*, *15*(Special), 13-21.

Joo, Y. J., Park, S., & Shin, E. K. (2017). Students' expectation, satisfaction, and continuance intention to use digital textbooks. Computers in Human Behavior, 83-90.

Khan, S. H. (2014). A model for integrating ICT into teacher training programs in Bangladesh based on TPCK. International Journal of Education and Development Using Information and Communication Technology, 10(3), 21-32.

Khan, M., Hossain, S., Hasan, M., & Clement, C. K. (2012). Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. Online Submission, 5(2), 61-80.

Kim, C., M., Kim, M. K., Lee, C., Spector, M., Meester, K. D. (2013). Teacher beliefs and technology integration. Teaching and Teacher Education,76–85.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? Contemporary Issues in Technology and Teacher Education, 9(1), 60–70.

Lantz-Andersson, A., Peterson, L., Hillman, T., Lundin,M., & Rensfeldt, A. B. (2017). Sharing repertoires in a teacher professional Facebook group. Learning, Culture and Social Interaction, 100(15), 44–55.

Lim, C. P., & Tay, L. Y. (2003). Information and communication technologies (ICT) in an elementary school: Students' engagement in higher order thinking. *Journal of Educational Multimedia and Hypermedia, 12*(4), 425–451.

Lim, C. P. (2002). A theoretical framework for the study of ICT in schools: A proposal. British Journal of Educational Technology, 4, 411-421.

Lynch, M. (2018). HOW TO OVERCOME 10 DIGITAL LEARNING CHALLENGES. https://www.thetechedvocate.org/how-to-overcome-10-digital-learning-challenges/

Mamun, A., & Tapan, S. (2009). Using ICT in teaching-learning at the polytechnic institutes of Bangladesh: constraints and limitations. Teacher's World-Journal of Education and Research, 33-34.

Mamataz, I. A. (4th March, 2017). Use of multimedia in classroom: Successes and challenges. https://www.daily-sun.com/post/209947/Use-of-multimedia-in-classroom:-Successes-and-challenges

Ministry of Education, Government of the People's Republic of Bangladesh. (2010). National Education Policy. https://moedu.gov.bd/site/page/318a22d2-b400-48a7-8222-303ab11cc205/-

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: a framework for integrating technology in teacher knowledge. Teachers College Record, 108(6), 1017–1054.

Mohammadi, F., Abrizah, A., Nazari, M., & Attaran, M. (2015). What motivates high school teachers to use web-based learning resources for classroom instruction? An exploratory case study in an Iranian smart school. Computers in Human Behavior, 373–381.

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: a review of the literature. Journal of information technology for teacher education, 9(3), 319-342.

Obaydullah, A. K. M., & Rahim, M. A. (2019). Use of ICT for Primary science Teaching and Learning at the Primary Schools in Bangladesh. *International Journal of Advance Research and Innovative Ideas in Education (IJARIIE)*, *5*(1), 642-651.

Patel, C. (2013). Use of Multimedia Technology in Teaching and Learning Communication Skill: An Analysis. International Journal of Advancements in Research & Technology, 2 (7), 116-123.

Penuel, W. R., Means, B., & Simkins, M. (2000). Teaching the Information Generation. Educational Leadership, 58, 34-38.

Rahman, T. (2015). *Challenges of using technology in the secondary English language classroom.* Unpublished Thesi). Brac University, Dhaka.

Sarowardy, M. H., & Halder, D. P. (2019). The issues and challenges of using multimedia at a district level, specialized girls' college in Bangladesh. *Creative Education*, *10*(07), 1507.

Salehi, H., & Salehi, Z. (2012). Challenges for Using ICT in Education: Teachers' Insights. International Journal of e-Education, e-Business, e-Management and e-Learning, 2(1), 40-43.

Sayed, M. A., Zaber, M., Ali, A., & Mosharaf, P. (2017). Enumerating the obstacles of accelerating the use of digital classroom: Lessons from Bangladesh. Available at SSRN 3044273.

Sang, G., Valcke, M., Van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. Computers & Education, 54(1), 103-112.

Shieh, R. S. (2012). The impact of Technology-Enabled Active Learning (TEAL) Implementation on Student Learning and Teachers' Teaching in a High School context. Computers & Education, 206–214.

So, T., & Swatman, P. M. (2006). e-Learning readiness of Hong Kong teachers. University of South Australia.

Tabata, L., & Johnsrud, L. (2008). The Impact of Faculty Attitudes Towards Technology, Distance Education and Innovation. Research in Higher Education, 49(7), 625-646.

Tella, A., Tella, A., Toyobo, O. M., Adika, L. O., & Adewuyi, A. A. (2007). An assessment of secondary school teachers uses of ICT's: Implications for further development of ICT's use in Nigerian secondary schools. TOJET: The Turkish Online Journal of Educational Technology, 6(3).

Tezci, E. (2011). Factors that influence pre-service teachers' ICT usage in education. European Journal of Teacher Education, 34(4), 483-499.

Tezci, E. (2009). Teachers' effect on ICT use in education: The Turkey sample. Procedia-Social and Behavioral Sciences, 1(1), 1285-1294.

Torres, J. A. (2017). Advantages, Challenges Encountered and Attitude of Teachers in Utilizing Multimedia in the Classroom. Journal of Social Sciences, 6, 348-356.

Walan, S. (2020). Embracing digital technology in science classrooms—secondary school teachers' enacted teaching and reflections on practice. *Journal of Science Education and Technology*, *29*(3), 431-441.

Wang, Q. (2008). A generic model for guiding the integration of ICT into teaching and learning. Innovations in Education and Teaching International, 45(4), 411-419.

Wallet, P., & Melgar, B. V. (2014). Information and Communication Technology (ICT) in Education in Asia.

Watson, S. L., & Watson, W. R. (2011). The role of technology and computer-based instruction in a disadvantaged alternative school's culture of learning. Computers in the Schools, 28(1), 39-55.

Wellington, J. (2004). Multimedia in science teaching. In R. Barton (Ed.), *Teaching secondary science with ICT* (pp. 87–105). McGraw-Hill Education.

Weng, C., Otanga, S., Weng A., & Cox, J. (2018). Effects of interactivity in e-textbooks on 7th graders science learning and cognitive load. Computers & Education, 172-184.

Williams,M., Linn, M. C., Ammon, P., & Gearhart, M. (2004). Learning to teach science in a technology-based environment: a case study. Journal of Science Education and Technology, 13(2), 189–206.

Williams, D., Coles, L., Wilson, K., Richardson, A., & Tuson, J. (2000). Teachers and ICT: Current use and future needs. British Journal of Educational Technology, 31(4), 307-320.

Windschitl, M., & Sahl, K. (2002). Tracing Teachers' Use of Technology in a Laptop Computer School: The Interplay of Teacher Beliefs, Social Dynamics, and Institutional Culture. American Educational Research Journal, 39(1), 165-205.

Xu, X. (2017). Study on Effective Using of Multimedia Teaching System and Enhancing Teaching Effect. International Journal of Emerging Technologies in Learning, 12, 187-195.

Zhang, J., & Zhang, Z. (2013). The Limitations and Application Errors in Multimedia Teaching of College. In 2012 First National Conference for Engineering Sciences (pp. 6). Paris: Atlantis Press.

Zhu, C. (2010). Teacher roles and adoption of educational technology in the Chinese context. Journal for Educational Research Online, II (2), 72-86.

Zhu, Z. (2003). On Educational Informatization and the transforms of educational cultures. Journal of Global Chinese Society of Computers *in Education, 1*.

Appendices

Appendix A

Table A 1: Do you take classes with the help of digital content and/or ICT?	
Yes	96.2%
No	3.8%

Table A 2: How often you develop digital content for science classroom?	
Daily	7.7%
Once or twice a week	50%
Once or twice a month	30.8%
Few times a year	3.8%
Never	7.7%
Do not know how to develop	0%

Table A 3: How often do you use digital content in your science classroom? (Frequency of using digital content)	
Daily	7.7%
Once or twice a week	50%
Once or twice a month	34.6%
Few times a year	3.8%
Never Used	3.8%
Do not know how to develop	0%

Table A 4: What type of digital content you use in science classroom?	
Text	11.5%
Picture/photo	38.5%
Self-made animation	7.7%
Video	30.8%
3D Model	0%
Other (Please specify)	11.5%

Table A 5: What language do you prefer to use for digital content?	
Bangla	100%
English	0%

Table A 6: How often do you use computer?	
Daily	23.1%
Once or twice a week	53.8%
Once or twice a month	19.2%
Few times a year	3.8%
Never Used	0%
Do not know how to develop	0%

Table A 7: What ICT knowledge you use frequently?	
Word processing (MS word)	3.8%
Spread Sheet (MS excel)	0%
Presentation (MS power point)	57.7%
Email	0%
Web browsing	7.7%
YouTube lecture	11.5%
Content Download from web sources	15.4%
Others (please specify)	3.8%

Table A 8: Do you have electricity at school?	
Yes	100%
No	0%

Table A 9: Do you have access to computer at school?	
Yes	96.2%
No	3.8%

Table A 10: How often you use computer at school?	
Always	11.5%
Most of the time	50%
Sometimes	26.9%
Never	11.5%
No response	0%

Table A 11: Do you have access to internet at school?	
Yes	92.3%
No	7.7%

Table A 12: How often do you use internet at school?	
Always	34.6%
Most of the time	46.2%
Sometimes	19.2%
Never	0%
No response	0%

Table A 13: Do you have ICT lab facility at school?	
Yes	88..5%
No	11.5%

Table A 14: How often do you use ICT lab at school?	
Always	11.5%
Most of the time	7.7%
Sometimes	46.2%
Never	34.6%
No response	0%

Table A 15: Do you have access to educational Materials from internet?	
Yes	100%
No	0%

Table A 16: What is your purpose to use of digital content?	
As an energizer/motivation to start the class	0%
to explain a concept	53.8%
to stimulate discussion	7.7%
for homework	0%
for assessment	0%
for making presentation	38.5%

Table A 17: Do you think/agree digital teaching materials are making science classes easy to organize?	
I completely agree	42.3%
I agree	34.6%
I agree to a little extent	0%
I don't agree	23.1%
No response	0%

Table A 18: Do you think/agree digital teaching materials are making science classes easy to design?	
I completely agree	30.8%
I agree	38.5%
I agree to a little extent	3.8%
I don't agree	26.9%
No response	0%

Table A 19: Do you think/agree through digital content science learning will be more structured?	
I completely agree	30.8%
I agree	30.8%
I agree to a little extent	11.5%
I don't agree	26.9%
No response	0%

Table A 20: I use digital teaching materials as new ways to learn	
I completely agree	23.1%
I agree	69.2%
I agree to a little extent	7.7%
I don't agree	0%
No response	0%

Table A 21: I use digital contents or teaching materials in science class for improving the efficiency of learning time	
I completely agree	19.2%
I agree	76.9%
I agree to a little extent	3.8%
I don't agree	0%
No response	0%

Table A 22: I use digital teaching materials in science class to lead students to automatic learning	
I completely agree	19.2%
I agree	50%
I agree to a little extent	23.1%
I don't agree	7.7%
No response	0%

Table A 23:I use digital teaching materials in science class to facilitate the students to access to information	
I completely agree	11.5%
I agree	73.1%
I agree to a little extent	7.7%
I don't agree	7.7%
No response	0%

Table A 24:I use digital teaching materials in science class to promote and ensure collaborative learning	
I completely agree	15.4%
I agree	73.1%
I agree to a little extent	11.5%
I don't agree	0%
No response	0%

Table A 25: Digital teaching materials facilitate teachers in enhancing interactive learning	
I completely agree	19.2%
I agree	73.1%
I agree to a little extent	7.7%
I don't agree	0%
No response	0%

Table A 26: Digital content increase students' skills in the decision-making process to solve problems	
I completely agree	30.8%
I agree	50%
I agree to a little extent	15.4%
I don’t agree	3.8%
No response	0%

Table A 27: Digital content is useful in supporting student self-reliance	
I completely agree	26.9%
I agree	53.8%
I agree to a little extent	19.2%
I don’t agree	0%
No response	0%

Table A 28: Digital content brings learning innovation to teaching	
I completely agree	34.6%
I agree	46.2%
I agree to a little extent	19.2%
I don’t agree	0%
No response	0%

Table A 29: Digital teaching materials or contents are very important as teaching materials	
I completely agree	26.9%
I agree	65.4%
I agree to a little extent	7.7%
I don’t agree	0%
No response	0%

Table A 30: Digital teaching materials or content support science teaching and learning activities more quickly.	
I completely agree	34.6%
I agree	61.5%
I agree to a little extent	3.8%
I don’t agree	0%
No response	0%

Table A 31: Digital content is useful as a tool for changing science learning in classroom teaching.	
I completely agree	23.1%
I agree	53.8%
I agree to a little extent	23.1%
I don’t agree	0%
No response	0%

Table A 32: Digital teaching material or contents accelerating students' understanding for science subjects	
I completely agree	30.8%
I agree	53.8%
I agree to a little extent	15.4%
I don't agree	0%
No response	0%

Table A 33: Digital teaching material or contents help students to understand science concepts	
I completely agree	23.1%
I agree	69.2%
I agree to a little extent	7.7%
I don't agree	0%
No response	0%

Table A 34: Digital teaching material or contents making students more active in science learning	
I completely agree	15.4%
I agree	76.9%
I agree to a little extent	7.7%
I don't agree	0%
No response	0%

Table A 35: How confident you feel while using digital teaching material or contents for science classes?	
I feel very confident	61.5%
I feel confident	30.8%
I feel a little confident	0%
I don't feel confident	3.8%
No response	3.8%

Table A 36: As a teacher I feel motivated to use digital content/multimedia for science teaching.	
I completely agree	38.5%
I agree	53.8%
I agree to a little extent	7.7%
I don't agree	0%
No response	0%

Table A 37: Digital content for science makes the learning process enjoyable to students.	
I completely agree	50%
I agree	42.3%
I agree to a little extent	7.7%
I don't agree	0%
No response	0%

Table A 38: Digital content or teaching materials for science subjects take time to be developed.	
I completely agree	42.3%
I agree	30.8%
I agree to a little extent	11.5%
I don't agree	15.4%
No response	0%

Table A 39: The use of digital teaching materials for science is less efficient for learning	
I completely agree	16.9%
I agree	13.1%
I agree to a little extent	11.5%
I don't agree	58.5%
No response	0%

Table A 40: Lack of technical support on hardware and software issue is a problem for using digital content in science classroom and teaching learning process	
I completely agree	38.5%
I agree	46.2%
I agree to a little extent	7.7%
I don't agree	7.7%
No response	0%

Table A 41: Unexpected power failure during class hour is a problem for using digital content in science classroom and teaching learning process	
I completely agree	42.3%
I agree	42.3%
I agree to a little extent	7.7%
I don't agree	7.7%
No response	0%

Table A 42: Lack of computer in school is a problem for using digital content in science classroom and teaching learning process	
I completely agree	34.6%
I agree	30.8%
I agree to a little extent	11.5%
I don't agree	23.1%
No response	0%

Table A 43: Limited knowledge on how to make digital content and how to use it is a problem for using digital content in science classroom and teaching learning process	
I completely agree	38.5%
I agree	50%
I agree to a little extent	3.8%
I don't agree	7.7%
No response	0%

Table A 44: Limited knowledge and challenges to use ICT it is a problem for using digital content in science classroom and teaching learning process	
I completely agree	36%
I agree	48%
I agree to a little extent	12%
I don't agree	4%
No response	0%

Table A 45: Lack of training in digital content preparation and application is a problem for using digital content in science classroom and teaching learning process	
I completely agree	44%
I agree	32%
I agree to a little extent	16%
I don't agree	4%
No response	4%

Appendix B

Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh

Questionnaire for Teachers

Dear Teacher

This questionnaire will be used to gather information pertaining to the study titled **Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh**. The study is for the partial fulfilment of requirements for the MPhil degree of Institute of Education and Research, University of Dhaka.

You have been chosen as a valuable respondent for the study and the information collected from here will be solely used to conduct research and the information of the participant will be kept confidential and anonymous. The participation is voluntary. Participants are free to not take part in this survey without any restrictions and can withdraw anytime during the survey.

Gender of the participant	Male		Female	
Educational qualification of the participant	PhD	Master degree	Bachelor degree	HSC
Teaching class at secondary level	Class VI-VIII		Class IX-X	
Teaching subject at school	General Science	Physics	Mathematics	Chemistry
	Biology			
Teaching experience	0-5 years	6-10 years	11-15 years	15 years +

1. Do you take classes with the help of digital content and/or ICT?
   - Yes
   - No
2. How often you develop digital content for science classroom?
   - Daily
   - Once or twice a week
   - Once or twice a month
   - Few times a year
   - Never
   - Do not know how to develop
3. How often do you use digital content in your science classroom? (Frequency of using digital content)
   - Daily
   - Once or twice a week
   - Once or twice a month
   - Few times a year
   - Never used
   - Do not know the use

4. What type of digital content you use in science classroom?
   - Text
   - Picture/photo
   - Self-made animation
   - Video
   - 3D model
   - Others (Please specify):
5. What language do you prefer to use for digital content?
   - Bangla
   - English
6. How often do you use computer?
   - Daily
   - Once or twice a week
   - Once or twice a month
   - Few times a year
   - Never used
   - Do not know the use
7. What ICT knowledge you use frequently?
   - Word processing (MS word)
   - Spread Sheet (MS excel)
   - Presentation (MS power point)
   - Email
   - Web browsing
   - YouTube lecture
   - Content Download from web sources
   - Others (please specify)
8. Do you have electricity at school?
   - Yes
   - No
9. Do you have access to computer at school?
   - Yes
   - No
10. How often you use computer at school?
    - Always
    - Most of the time
    - Sometimes
    - Never
    - No response
11. Do you have access to internet at school?
    - Yes
    - No

12. How often do you use internet at school?
    - Always
    - Most of the time
    - Sometimes
    - Never
    - No response
13. Do you have ICT lab facility at school?
    - Yes
    - No
14. How often do you use ICT lab at school?
    - Always
    - Most of the time
    - Sometimes
    - Never
    - No response
15. Do you have access to educational Materials from internet?
    - Yes
    - No
16. What is your purpose to use of digital content?
    - As an energizer/motivation to start the class
    - to explain a concept
    - to stimulate discussion
    - for homework
    - for assessment
    - for making presentation
17. Do you think/agree digital teaching materials are making science classes easy to organize?
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
18. Do you think/agree digital teaching materials are making science classes easy to design?
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
19. Do you think/agree through digital content science learning will be more structured?
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response

20. I use digital teaching materials as new ways to learn
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
21. I use digital contents or teaching materials in science class for improving the efficiency of learning time
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
22. I use digital teaching materials in science class to lead students to automatic learning
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
23. I use digital teaching materials in science class to facilitate the students to access to information
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
24. I use digital teaching materials in science class to promote and ensure collaborative learning
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
25. Digital teaching materials facilitate teachers in enhancing interactive learning
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response
26. Digital content increase students' skills in the decision-making process to solve problems
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don’t agree
    - No response

27. Digital content is useful in supporting student self-reliance
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
28. Digital content brings learning innovation to teaching
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
29. Digital teaching materials or contents are very important as teaching materials
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
30. Digital teaching materials or content support science teaching and learning activities more quickly.
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
31. Digital content is useful as a tool for changing science learning in classroom teaching.
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
32. Digital teaching material or contents accelerating students' understanding for science subjects
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
33. Digital teaching material or contents help students to understand science concepts
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response

34. Digital teaching material or contents making students more active in science learning

- I completely agree
- I agree
- I agree to a little extent
- I don't agree
- No response

35. How confident you feel while using digital teaching material or contents for science classes?

- I feel very confident
- I feel confident
- I feel a little confident
- I don't feel confident
- No response

36. As a teacher I feel motivated to use digital content/multimedia for science teaching.

- I completely agree
- I agree
- I agree to a little extent
- I don't agree
- No response

37. Digital content for science makes the learning process enjoyable to students.

- I completely agree
- I agree
- I agree to a little extent
- I don't agree
- No response

38. The use of digital teaching material for science is difficult and takes a lot of time.

- I completely agree
- I agree
- I agree to a little extent
- I don't agree
- No response

39. The use of digital teaching materials for science is less efficient for learning.

- I completely agree
- I agree
- I agree to a little extent
- I don't agree
- No response

40. Lack of technical support on hardware and software issue is a problem for using digital content in science classroom and teaching learning process

- I completely agree
- I agree
- I agree to a little extent
- I don't agree
- No response

41. Unexpected power failure during class hour is a problem for using digital content in science classroom and teaching learning process
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
42. Lack of computer in school is a problem for using digital content in science classroom and teaching learning process
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
43. Limited knowledge on how to make digital content and how to use it is a problem for using digital content in science classroom and teaching learning process
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
44. Limited knowledge and challenges to use ICT it is a problem for using digital content in science classroom and teaching learning process
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response
45. Lack of training in digital content preparation and application is a problem for using digital content in science classroom and teaching learning process
    - I completely agree
    - I agree
    - I agree to a little extent
    - I don't agree
    - No response

Appendix C

Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh

Teachers' Focus Group Discussion (FGD)

This focus group discussion (FGD) will help to gather information pertaining to the study titled **Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh**. The study is for the partial fulfilment of requirements for the MPhil degree of Institute of Education and Research, University of Dhaka.

You have been considered as a valuable respondent for the study and the information collected from here will be solely used to conduct research and the information of the participant will be kept confidential and anonymous. The participation is voluntary. Participants are free to not take part in this FGD without any restrictions and can withdraw anytime during the discussion.

Different aspects of discussion

1. How would you define digital content?
2. How often do you use digital content in your class? Please elaborate with example.
3. Do you think digital content is useful for science teaching learning? Please explain.
4. Why do you use digital content in your class?
5. How you use digital content for science students? Please provide example.
6. What are the problems you encountered while using digital content in your classroom? Please provide example.
7. How the problems effect the use of digital content in classroom? Explain.
8. What are the challenges of using digital content in science teaching learning process?

Appendix D

Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh

Interview Guideline for Head Teacher (KII)

This interview guideline will help to gather information pertaining to the study titled **Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh**. The study is for the partial fulfilment of requirements for the MPhil degree of Institute of Education and Research, University of Dhaka.

You have been considered as a valuable respondent for the study and the information collected from here will be solely used to conduct research and the information of the participant will be kept confidential and anonymous. The participation is voluntary. Participants are free to not take part in this interview without any restrictions and can withdraw anytime during the discussion.

Different aspects of interview

1. How would you define digital content?
2. How often do the science teachers use digital content in classroom? Please explain your answer.
3. Do you think digital content is useful for science teaching learning? Explain please.
4. Why do teachers need to use digital content in science class?
5. What are the problems teachers encountered while using digital content in your classroom? Please provide example.
6. How the problems effect the use of digital content in classroom? Explain.
7. What are the challenges of using digital content in science teaching learning process?

Appendix E

Challenges of Using Digital Content in Secondary Science Classrooms in Bangladesh

Observation Guide for classroom

1. What technologies teacher use in class?
2. How does teacher make students involved with technology?
3. How do students' response to the class?
4. How long teacher use ICT in classroom?
5. Ability of teacher to combine digital content and lessons?
6. Are the students attentive in classroom or they misusing the technology?
7. What method or methods teacher is using in the classroom?
8. Consistency of using digital content according to lessons?
9. Challenge/s faced by teacher to implement ICT and digital content in classroom teaching learning?
10. Recommendations: