Ministry of Science and Higher Education of the Republic of Kazakhstan

Suleyman Demirel University

Gulnara Saimassay

Analysis of students' interest in programming

THESIS

Presented in Partial Fulfilment for the

Master of Technical Sciences Degree in Computer Science

(degree code: 7M06102)

Department of Computer Science

Faculty of Engineering and Natural Sciences

Supervisor: **Assistant Prof. PhD, Zhaparov M.**

Kaskelen 2023

Suleyman Demirel University
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Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

Gulnara Saimassay

2023

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Dedication

I dedicate this thesis to my family, supervisor, friends, participants, and mentors. Your unwavering support, guidance, and contributions have been instrumental in my academic journey. Thank you for believing in me and being a part of my growth.

Abstract

The proportion of women working in and studying computer science (CS) remains much lower than that of men. Young women's perceptions of computer science as a career are highly impacted by their sense of self and identity. We believe that if young girls are introduced to software programming in a way that enables them to explore their identities early on, they will be more likely to pursue careers in CS. This research looks at the role of gender diversity and cultural stereotypes in affecting girls' job choices outside of information technology (IT). The study attempts to explore the underlying causes of this trend by investigating gender inequalities and identifying the primary factors impacting girls' views and attitudes about computers and ICT education. Furthermore, the research intends to establish an optimum atmosphere that fosters girls' interest in IT and encourages women's engagement in IT careers. The study looks at the relationship between confidence and satisfaction levels using a case study technique using before and post questionnaires. The obtained data is evaluated to identify the influence of these elements on the vision and interest of females in IT. The results help to explain gender discrepancies in job choices and provide suggestions for developing a supportive and inclusive atmosphere to enhance girls' interest in IT. The report emphasizes the necessity of tackling cultural preconceptions and encouraging gender diversity in order to create an atmosphere that encourages girls to pursue careers in IT and promotes women's participation in IT occupations.

Аңдатпа

IT саласында жұмыс істейтін және оқитын әйелдердің үлесі ерлерге қарағанда айтарлықтай төмен. Қыздардың информатиканы мамандық ретінде қабылдауы олардың өзін-өзі бағалауы мен айдентикасына байланысты. Егер қыздар ерте бағдарламалаумен таныстырылатын болса, олар IT мамандық таңдауға бейім болады деп ойлаймыз. Бұл зерттеу қыздардың ақпараттық технологиядан тыс жұмыс таңдауына әсер ететін гендерлік әртүрлілік пен мәдени стереотиптердің рөлін зерттейді. Зерттеу гендерлік теңсіздікті зерттеп, қыздардың компьютерге және АКТ біліміне деген көзқарасы мен көзқарасына әсер ететін негізгі факторларды анықтау арқылы осы тенденцияның түпкі себептерін ашуға тырысады. Сонымен қатар, зерттеу қыздардың АТ-ға қызығушылығын арттыратын және әйелдерді IT-мансапқа қатысуға ынталандыратын оңтайлы ортаны құруға тырысады. зерттеу аясында сенім мен қанағаттану деңгейі арасындағы байланыс конверсиялық және кейінгі сауалнамаларды қолдану арқылы кейс-стадтық әдістемені пайдалана отырып зерттеледі. Алынған деректер осы элементтердің әйелдердің АТ-ға деген қабылдауы мен қызығушылығына әсерін анықтау үшін талданады. Нәтижелер мансап таңдаудағы гендерлік олқылықтарды түсіндіруге көмектеседі және қыздардың ақпараттық технологияларға қызығушылығын арттыру үшін қолдау көрсететін және инклюзивті ортаны құру бойынша ұсыныстар береді. Баяндамада қыздарды IT саласында мансап таңдауға ынталандыратын және әйелдердің IT-мансапқа қатысуына ықпал ететін ортаны құру үшін мәдени бейімділікпен күресу және гендерлік әртүрлілікті ілгерілету қажеттілігі көрсетілген.

Аннотация

Пропорция женщин, работающих и изучающих информатику и компьютерные науки (КН), остается значительно ниже, чем у мужчин. Восприятие компьютерных наук как профессии у молодых женщин сильно зависит от их самооценки и идентичности. Мы считаем, что если молодые девушки знакомятся с программированием в рамках, которые позволяют им рано исследовать свою личность, они будут более склонны выбирать карьеру в области КН. Это исследование рассматривает роль гендерного разнообразия и культурных стереотипов влияющих на выбор работы девочек вне сферы информационных технологий (ИТ). Исследование пытается выявить основные причины этой тенденции, исследуя гендерные неравенства и выявляя основные факторы, влияющие на взгляды и отношение девочек к компьютерам и образованию в области ИКТ. Более того, исследование стремится создать оптимальную атмосферу, которая способствует интересу девочек к ИТ и поощряет участие женщин в ИТ-карьере. В рамках исследования рассматривается связь между уровнем уверенности и удовлетворенности с использованием методики кейс-стади с применением предварительных и последующих опросников. Полученные данные анализируются для определения влияния этих элементов на восприятие и интерес женщин к ИТ. Результаты помогают объяснить гендерные расхождения в выборе профессий и предоставляют рекомендации по созданию поддерживающей и инклюзивной атмосферы для увеличения интереса девочек к ИТ. Отчет подчеркивает необходимость борьбы с культурными предрассудками и поощрения гендерного разнообразия для создания атмосферы, которая будет поощрять девочек выбирать карьеру в ИТ и способствовать участию женщин в ИТ-профессиях.

Abbreviations

SPSS - Statistical Package for the Social Sciences
IT Information Technologies
ICT Information Communication Technologies
CS Computer Science
STEM Science, technology, engineering, and mathematics
PwC PricewaterhouseCoopers
SLA Second language acquisition
PC Personal computer
CAQDAS Computer-assisted qualitative data analysis software

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Chapter 1

Background and motivations

1.1 Introduction

Everyone, regardless of age, will have a tough time mastering programming languages. The ability to grasp algorithms, in addition to the programming language and grammar, is one of the primary challenges that new learners face in the early stages of their education. Everyone starts off by studying a programming language such as Java, Python, or another one. What are some solutions to the problem that programming is "difficult and time-consuming"? How are we going to make something that is "difficult and time-consuming" into something that is "easy and quick"? Block-based and visual programming are where you'll find the answer you're looking for.

In today's market, where there is a high need for software development and every business is essentially a software company, the ability to program has evolved into a skill that is absolutely necessary. When you go into the history of the programming languages, you will find that engineers developed them specifically for use by other engineers. This renders programming nearly unreachable to end-users, who may want to make minor modifications to the application without continuously consulting the developer or even building a fundamental app for personal use. Numerous people have spent a significant amount of time and effort developing a variety of programming languages and tools in order to overcome this issue. The goal of these efforts has been to make programming simpler and more accessible to corporate users as well as "citizen developers." Students who are unable to comprehend both grammar and algorithms typically give up on coding and do not attempt it again, despite the fact that the most difficult part of coding is just understanding the method. The use of block-based platforms can serve as a springboard for beginners and as a motivational tool for students learning to code [1]. Instruction in algorithms and instruction in the syntax of at least one of the languages are often included in school and university courses.

Concerns have been raised over the low number of females employed in the information technology sector, which has been well-documented. However, beginning instruction in information technology (IT) at the elementary school level can significantly affect girls' impressions of the area as well as their interest in it. The findings of this research point to a few crucial elements connected to early exposure to computers and its effect on girls' interest in pursuing careers in computer science:

Exposure to computing at an early age has been demonstrated that it has a beneficial influence on the interest that females have in computer science [2]. When females are engaged in technology education at a young age, it helps shape their views about technology and develops their interest about it. This is especially important for younger girls. Decrease in interest It has been found that during basic and secondary education, females' interest in computers tends to drop, with very minimal recovery in later stages. When compared to males, girls typically report having lower levels of confidence in their ability to do scientific and computational tasks, particularly during elementary and middle school. There is a widespread belief among children and teenagers that, compared to males, girls have less of an interest in fields such as computer science and engineering. Specifically, this belief stems from societal prejudices. The vast majority of youngsters are under the impression that girls are less likely to pursue careers in disciplines like engineering and computer technology. In light of these findings, it is absolutely necessary to investigate the elements that influence the views and interests of females in the field of computer science. We can dismantle prejudices and advance gender equality in the field of information technology if we begin girls' education in information technology at an early age and encourage their participation. It is essential to the development of girls' curiosity and self-assurance to provide an atmosphere that welcomes diversity and supports females in their quest to realize their full potential in information technology.

We may encourage young women to seek professions in information technology by drawing attention to the significance of equal opportunities, presenting women who have achieved success in the sector, and offering role models. It is of the utmost importance to cultivate an educational environment that encourages the participation of females, caters to their specific educational requirements, and draws attention to the importance of computer technology in the lives of young women[3]. In addition to this, efforts should be focused on the development of individualized educational techniques that are catered to the unique learning styles and interests of females. We may improve girls' comprehension of computer science and give them the confidence to follow their interests in the subject by embracing a variety of teaching techniques, such as learning based on projects, learning through hands-on activities, and learning via interactive experiences [4].

Early exposure to information technology education as well as addressing the underlying variables that impact girls' attitudes are critical steps towards expanding the presence of women in the information technology business. We can motivate and encourage girls to pursue successful careers in computer science by cultivating an atmosphere that is welcoming to all and advocating for equitable access to educational and professional opportunities.

The primary goals of the research are to identify the primary challenges that students have when learning coding and algorithms and to suggest a solution that is tailored to those challenges. We need to do research on how schools now implement information and communications technology (ICT), as well as the interests and behaviors of current pupils. These components will serve as the foundation for the primary aspects of the instructional tool.

The problems that need answering are as follows:

- Why do students have difficulties grasping the coding algorithms?

- What factors contribute to the widespread perception that programming is difficult?
- What are the primary motivating forces that drive pupils to acquire new abilities?
- What is the impact of females' decreased interest in IT?
- What is the reason girls being minority part of IT jobs?

The study's goal is to explore into the underlying causes behind females' preference for fields other than IT, with an emphasis on gender diversity and cultural prejudices. Girls are often underrepresented in the area of information technology, which may be ascribed to a variety of issues such as cultural expectations, prejudices, and restricted exposure to possibilities. We want to get a complete knowledge of gender disparities and the primary factors impacting girls' views and attitudes toward computers and ICT education by completing this study. We will investigate how social norms and cultural stereotypes influence their vision and career goals in the area of information technology.

This research also aims to investigate the current educational environment and identify any hurdles to girls' interest in IT. We may recommend ideas and interventions to build a more supportive and inclusive learning environment by recognizing these impediments. Curriculum changes, teacher training programs, mentoring activities, and awareness campaigns aimed at both students and parents are examples of such interventions. In addition, the research intends to promote the value of diversity and gender equality in the IT business. We may fight for equal opportunities and seek to break down gender barriers that deter girls from pursuing careers in IT by emphasizing the advantages of a gender-balanced workforce.

The purpose of this study is to investigate the reasons behind students' interest in programming, including whether or not self-confidence may help girls become more interested in information technology and whether or not students select programming because of its underlying causes.

Ultimately, the purpose is to encourage and empower young women to pursue careers in information technology. We want to boost the representation of girls in IT and encourage more women to pursue fulfilling professions in this area by establishing a favorable atmosphere that encourages their interest and provides them with the necessary assistance and tools. We believe that the outcomes of this study will help to larger initiatives to promote gender equality and create a more varied and inclusive IT workforce.

Chapter 2

Literature review

2.1 Programming education at primary school level

At the present, there is a lot of focus on the concept that children all around the world should learn to code. According to [5, 6, 7], programming and computer science education can help students acquire critical 21st-century skills such as problem solving, creativity, and higher-order thinking. All of these characteristics are anticipated of people in the twenty-first century. In this context, the importance of programming education has been acknowledged on a worldwide basis, and as a result, many countries' educational systems have been altered accordingly. While some countries are updating the information covered in primary computer lessons, others are providing programming training at many levels for the first time. Furthermore, the quantity of classroom teaching given for programming, as well as the abilities expected to be learned upon completion of this schooling, varies by country.

Women make up a relatively small fraction of students enrolled in computer science programs these days. According to research done by Corbett and Solving (2015), just 1% of first-year college women planned to major in computer science. A high level of computer self-efficacy influences the choice of whether or not to enroll in computer science (CS) courses while attending school [8, 9]. The use of computers requires a certain level of self-assurance, which may be improved with early exposure to computing; nevertheless, girls lack pre-college exposure to computing more so than their male counterparts do. According to Cheryan, Master, and Meltzoff's research, the perception that computer science is a male-dominated field and the notion that girls have a lower aptitude for areas related to computing discourage women from pursuing education in computer programming. [10].

Currently, women make up 48% of graduates from medical schools and 47% of graduates from legal schools [10, 11]. Even within the fields of STEM (science, technology, engineering, and mathematics), women earn the majority of undergraduate degrees in the United States (59 percent) in biology and almost half in both chemistry and mathematics. Nevertheless, women only make up fewer than 20% of undergraduate degree recipients in the fields of computer science and engineering [10].

Particularly in the subject of computer technology, stereotypes may have a profound effect on how people operate. The search results presented imply that gender prejudices exist in computer courses, which can have a detrimental impact on both future course choices and grades. Some of the most important findings from the search are as follows: Computer science and gender roles: Internal validity of gender stereotypes in a computer science course was investigated in a recent research. According to the research, gender stereotypes indeed exist in computing classes and have an impact on students' impressions of themselves and the sector as a whole. The negative effects of stereotypes include impaired performance in the stereotyped group and, specifically, a gender gap in test scores between men and women on exams that are stereotypically associated with males. Belonging in a field might be hampered by preconceived notions about its gender compatibility; for example, the perception that CS is unsuitable for women. Females seem to have more positive preconceptions than males do, according to a recent research on gender stereotypes. However, unfavorable preconceptions forecast less interest in and performance in future computer science courses. Changing media portrayals and role models is one way to work toward more gender parity in the workplace and society at large. Women's underrepresentation in male-dominated disciplines and professions can be improved by recognizing and eliminating masculine defaults [12].

According to a 2015 study conducted by the European School Network, 18 European countries have integrated programming education in their primary school curriculum. For a variety of reasons, these 18 European nations have integrated programming instruction in their curriculum plans. When looking at what nations want from programming education, the most common expectation is that it will "support students' logical thinking and problem-solving skills." In addition to the 18 countries in Europe that are shown in Table 1, there are other nations all over the world that incorporate programming instruction within their basic educational systems. In this regard, the purpose of the study is to investigate the ways in which nations incorporate the teaching of programming into their respective curriculum and to investigate the ways in which programming education varies from country to country.

Education in programming is often beginning at the undergraduate level everywhere you go in the globe [6]. However, in recent times, particularly in industrialized nations, various arrangements have been established to disseminate programming instruction to a larger audience. The goal of these arrangements is to instill a passion for coding in kids at a younger age and to begin their education in programming at a younger age. For instance, in the United Kingdom, beginning in November 2013, students have been able to begin learning computer programming in schools beginning with the elementary level, and 2014 has been designated as the "Year of Code" across the whole nation [13]. Because it "could not keep up with the times," the curriculum of the information and communication technologies course that is taught in schools has been altered to include a mandatory and substantial portion on programming. This modification was made because the previous version of the course "could not keep up with the times." They have developed programming education that is unique to each level for the age groups 5-6, 7-11, and 11-14 by separating programming education in schools into phases. These age groups range from 5-6, 7-11, and 11-14. In the first stage, for children ages 5 to 6, the objective is to impart an understanding of what an algorithm is; in the second stage, for children ages 7 to 11, the objective is to enable students to develop more complicated programs and to be able to diagnose mistakes. Students in the third stage (ages 11 to 14) are required to have a proficient level of knowledge in at least two different programming languages [14].

The United States of America is putting a significant amount of effort into the instruction of coding in its schools. This endeavor is being supported by the federal government, civil society groups, and technology and software corporations such as Microsoft and Google. The "code.org" platform, which was launched in 2013, is one of the most notable of these initiatives. pupils in the United States are able to develop their own programs utilizing hundreds of different coding ideas since this platform, which is utilized by about 6 million pupils, is available to them [14].

South Korea's Ministry of Science and Future Planning recently made the announcement that beginning in elementary school, students would be required to take computer programming classes in order to produce an extremely trained labor force. The statement states that elementary schools will progressively start offering programming education in 2017, and that high schools would begin the same in 2018 [15]. With this approach, it was underlined that the focus should be on comprehending algorithms rather than computer operations at the basic school level [16].

When we examine the educational system of India, which has achieved major advancements in the field of software, we find that computer instruction is incorporated into the curriculum at virtually every level. A primary school student in India receives instruction on the fundamentals of algorithms as part of their education between the first and fourth grades. They make the switch to the BASIC programming language and begin studying topics like as constants, variables, and loops while they are in middle school. At the high school level, the curriculum is structured to teach students how to write more complex computer programs. It was agreed in 2012 to begin teaching students how to code beginning in the first grade of primary school in Estonia as part of a pilot program that was launched in that same year [17].

Beginning in the first grade (or at the age of five), the Australian Ministry of instruction intends to implement a basic programming language and coding instruction curriculum in all public schools across the country beginning in the year 2015. The courses will eventually evolve into more complex programming classes, and a mechanism has been devised to ensure that an average student of 7 years old will have mastered the fundamental logic of programming [18, 19]. A study that was carried out in France in 2015 came to the conclusion that early childhood education may be used to teach children the fundamentals of programming. The development of pupils' intuitive strength and their capacity for visual thinking is the goal of this instruction. In addition to this, it intends to teach youngsters that people, not computers, are the ones who write computer programs [20].

For the purpose of demonstrating that "programming is not just a man's job," a project known as "Programmer Girls" is now being carried out in Hungary. Middle school girls are receiving instruction in the "Processing" programming language as part of the scope of this initiative. This effort, which is receiving backing from a variety of civil society organizations as well as governments throughout the world [21], is expanding every day. It has been noted that children in China begin receiving instruction in fundamental coding at a younger age than in other countries. Early childhood education in China includes the teaching of fundamental coding concepts through the use of card games [22]. When the studies done on programming in other countries are analyzed, it is clear that nations are placing a greater emphasis on the value of programming education, and there is a growing trend in many countries to begin teaching programming at a younger age. In this regard, it would be helpful to examine the present situation in our nation in order to compare it to the studies that have been carried out in other countries.

In Turkey, as is the case in other countries, the priority that is being placed on the education of programmers is steadily growing. In Turkey, computer classes that were formerly known as "Computer Science" and "Information Technologies" were renamed "Information Technologies and Software" in 2012 as a result of a decision. This change was made within the context of the aforementioned scope. The word "software" was incorporated in the name of the class for the very first time, and as a result, the syllabus was expanded to include material on algorithms and programming. [23] Beginning in the fifth grade, pupils have had the opportunity to get instruction in fundamental programming concepts. In Turkey, several non-governmental groups, universities, private businesses, and the Ministry of National Education collaborate on a variety of initiatives to spread awareness about the importance of computer programming education. Students and instructors, for instance, have the ability to create original programs by using the EBA portal that was built inside the Ministry of National Education. Additionally, they have the ability to view the code lines of a program that was produced by someone else and make modifications to that program. In addition, in the year 2014, a conference known as "Computer Programming Children's Toy" was put on with the assistance of the Turkish Informatics Association and a number of different universities. This event's objective is to demonstrate to kids in elementary, middle, and high schools that it is possible for them to build their own programs using computer and internet technology, and that doing so is a straightforward process [24].

With the introduction of the distance learning method, more expansive opportunities for the use of information and communication technology (ICT) in the educational process have become available. This method in particular calls for the development of programs that enable students to independently study a subject matter and be evaluated in the most uncompromising manner, which is when the evaluation cannot be influenced by subjective opinion or the human factor. There are currently many different types of Internet exams, online lectures, and webinars being held, all of which will assist to increase the amount of experience and information that can be shared between educational institutions on a republican or worldwide scale. This kind of communication might be beneficial for competitive purposes, amongst students of various colleges to acquire the greatest learning results and collaboration skills possible. Kazakhstan is making an effort to maintain its position at the forefront of the trend toward increased popularity of programs. There have only been a handful of programs carried out by independent groups and elementary schools in the local community with the goal of piqueing people's interest in programming [25]. The most well-known organization is called Hour of Code, and it employs the utilization of video games like Minecraft to educate students about computer programming in a way that is both engaging and attention-grabbing [26]. In addition, in order to get the greatest possible outcomes, the information and communications technology (ICT) curriculum at local schools is progressively undergoing certain revisions. In addition, there are certain private schools that provide courses in order to introduce pupils to the world of programming. One of them is called Element school, and it provides instruction in programming, web design, 3D design, and robot manufacture to students between the ages of seven and eight, nine and twelve, and thirteen and sixteen. Students are able to have a better understanding of programming as a method for problem-solving thanks to these training sessions. When taking these research into consideration, it is reasonable to draw the conclusion that programming education has also acquired importance in our nation [22].

Programming education has started making its way into the national school curriculum of countries all over the world [27, 28, 29, 30, 31]. According to findings from a survey conducted in 2015 that questioned 21 Ministries of Education throughout Europe to determine the extent to which programming has been included into national curricula [27], this tendency has been notably prominent in Europe. The application of game design principles to settings that do not traditionally include gaming is known as "gamification". However, the term is also used in other situations, as reported by Plass et al., who describe gamification as "...the use of game characteristics, such as reward systems, to drive players to engage in a work they might otherwise find unappealing." [32] The non-profit group Project Tomorrow conducts yearly surveys in schools across the United States. [29] is the name of one more piece of independent study that polled 694 K-8 teachers in the United States regarding their use of digital games in the classroom. According to the findings, even though 74% of educators employed digital games for instructional reasons, they lamented the absence of curriculum-aligned games as well as help for introducing games into the classroom. In a similar vein, Becker observed that one of the difficulties that teachers have when adopting new technology into pedagogy is a lack of resources for locating accessible goods and tools in his research. In the end, Takeuchi and Vaala came up with several suggestions for enhancing the game integration into the teaching process.

Country name	Supporting Logical Thinking Skills	Supporting Problem Solving	Engaging Students in IT	Supporting Coding Skills	Supporting IT Employment	Supporting Other Key Competencies
Austria	+	+	+	+	+	+
Belgium			+		+	+
Bulgaria	+	+	+	+		
Czech Republic	+	+	+	+	+	+
Denmark	+	+				+
Estonia	+	+	+			+
Finland	+	+		+		
France			+		+	+
Ireland	+	+	+	+		+
Israel	+	+	+	+	+	+
Hungary	+	+				
Lithuania	+			+		
Malta			+	+		
Poland	+	+	+	+	+	+
Portugal	+	+			+	+
Spain	+	+		+		+
Slovakia	+	+				
United Kingdom	+	+	+	+	+	

Table 2.1: Review of countries that integrated programming for primary school

several of these ideas include building a framework for defining and evaluating educational games, boosting understanding about how to integrate games, and developing new integration models [33]. The usage of a text-based programming language (like Python) as opposed to a block-based language (like Scratch) is one of the characteristics that helps to differentiate the various settings for learning how to program. In Kelleher and Pausch's taxonomy of innovative programming environments, block-based systems are placed in the "discover alternatives to typing" category [34]. Because inexperienced programmers usually struggle with the syntax of a textual language, the use of block-based systems is one of the key incentives for utilizing such systems. Because it is not necessary to enter in instructions that are syntactically accurate, block-based programming languages can facilitate teaching in programming concepts while eliminating the need to battle with syntax.

Scratch, Thunkable, and MIT Scratch are the three systems that are most suited for youngsters. Inventor of Apps. The program known as App Inventor is hosted in the cloud. A web browser, an email account, and either a connected phone or an emulator are all that are required for developers to create mobile applications for Android phones using this platform. According to Morelli et al., App Inventor is an appropriate platform for incorporating computational thinking into the K-12 educational system [35]. They put together a group consisting of two undergraduate students, two high school computer science instructors, and an undergraduate computer science instructor in order to perform an experiment in which all of the individuals were required to learn how to utilize App Inventor. They supply the students with online lectures that can be obtained on the App Inventor website, and they give the students four weeks to educate themselves on the fundamentals of App Inventor on their own. The children understood it right away and promptly started working on their respective applications. Despite the fact that they had no previous experience with programming, they successfully modified the code such that it would work with their application. In addition, when the students had finished their applications, they served as mentors and assistants to the teachers who had signed up for the program. Because students and teachers utilized App Inventor to learn, improve, and build more complicated apps, the outcome was successful.

App Inventor was found to give a solid foundation for students to help them in the process of developing an app and understanding the programming behind it, as revealed by Amber Wagner and her colleagues [36]. Their test consisted of two different approaches: one that was block-based and utilized App Inventor, and another that was text-based and used Java. There were a total of 40 pupils, 14 of whom had prior experience in programming from their time in high school. They went over the fundamentals of App Inventor over the course of two days. After that, they went to Java to develop and build their first piece of software, which was called the "HelloPorr app." The researchers found that using a visual blocking language creates a fascinating new environment for generating computational thought. This was in compared to the text-based language. Students would feel more comfortable constructing apps if they were first exposed to a visual language platform, then to Java, according to the ideas put up by Wagner and Amber.

Students were able to build and construct their own apps using a text-enhanced graphical programming environment, as stated by Joey et al. [1]. It was done through the usage of BrickLayer, which is a text-enhanced graphical programming environment. The authors conceived up and carried out the project specifically for junior high school students. The BrickLayer was developed to meet the needs of the programming requirements of a wearable computing workshop. The workshop's primary objective was to teach students on fundamental electrical and electrical concepts through the medium of programming. Students developed programs to interpret sensor signals from devices such as light sensors and accelerometers that they constructed themselves. They were able to develop and construct the application with the help of BrickLayer. The children in elementary school thought the Scratch session to be exciting and intriguing, while the children in junior high school did not. The students in the advanced placement computer programming class came to the conclusion that the workshop was too challenging since they need a great deal of support to finish their projects. Aside from that, students had a positive impression of the BrickLayer session, describing it as intriguing, engaging, and instructional.

Scratch is a free web-based programming tool that enables young people to produce media projects relating to their specific interests and experiences, such as games, interactive stories, and animations. Scratch was created by MIT and is hosted on the Internet. The creation of projects involves combining several graphical components in order to provide a behavior for digital characters (also known as "sprites"). Resnick and co-authors present an overview of the programming language Scratch. Scripts are the building blocks of Scratch applications, and they are responsible for controlling the sprites that are displayed on a stage. To create scripts, you may construct scripts by dragging and dropping blocks that represent components of programs such as expressions, conditions, statements, and variables. It is possible for a sprite to have many scripts that are all executed at the same time. Syntax errors are automatically fixed, and real-time visual feedback is offered by the environment in the form of the sprites' actions. Scratch now has a social computing network that allows users to collaborate on projects. After-school programs frequently use Scratch as their programming language of choice [37]. For instance, Maloney, Peppler, Kafai, Resnick, and Rusk reported on an experiment where Scratch was used by children in an after-school clubhouse [38]. These pupils chose themselves, set their own educational paces, and received no formal instruction whatsoever. Through analyzing the work of the students, they came to the conclusion that the vast majority of the projects that resulted in executable scripts utilized both sequential and concurrent execution. They came to the conclusion that "most Scratch users use numerous threads without realizing it." Due to the fact that the students do not appear to have a cognitive awareness of what they are doing, we are unable to deduce that they have learned and comprehended this essential concept.

Wilson and Moffat conducted an investigation on the usage of Scratch as a means of instructing programming to children aged eight [39]. As part of their studies in Information and Communication Technology, these students devoted eight weeks and one hour each week to learning Scratch. Their lessons took place all throughout the school day. The students expressed their gratitude for the sessions and shown a higher level of engagement compared to their previous classes. The authors only reported on two mean grades, both of which were between 52 and 64, from a total of 12 students who participated in two quizzes (which were not given in the study). Because of the limited scope of the study, we are unable to draw any conclusions based on the students' level of comprehension. Scratch is also utilized as a short introduction to programming at the tertiary level since it appears to facilitate the transfer to more traditional settings [40]. According to Malan and Leitner, students loved using Scratch, and it was helpful in acquainting students who were not familiar with programming with the fundamentals of the language [41]. However, the only data included in this study came from questionnaires. During a panel discussion, Wolz, Leitner, Malan, and Maloney disclosed that it appeared to be easier for students to transfer their knowledge of Scratch to Java or C [27].

2.2 All girl environment in education

According to [42], single-sex teaching has the potential to have a beneficial impact on both young women and young men. Several studies concluded that middle school-aged girls had a more favorable reaction to the topic of computer science when it was taught to them in an all-girl week-long summer coding camp environment [43, 44]. Participants in the single-sex environment exhibited more interest in computer science and performed higher on examinations, according to a research that compared a mixed-gender programming class to an all-girl class at the high school level. The study was conducted by Dr. Robbnis and was published in 2010. Simpson and Che observed that the girls who were taught mathematics in an all-girl setting spoke more favourably about their experience than the girls who were taught mathematics in a setting that included both genders. They cited this finding in Simpson 2016's phenomenological study. According to the findings of Graff's study [42], girls who were in the single-sex group reported feeling more comfortable and were treated more seriously. [45] is the name of a research that was conducted at the university level and concluded that participation in a single-sex STEM program had a beneficial affect on women's involvement in the STEM areas. According to the findings of Cherney and Campbell, females who were exposed to STEM subjects in an environment with just one gender had better levels of self-esteem.

Occupational stereotypes consist of the personalities and lifestyles of individuals who work in the occupation, the work that is done and the incentives that are offered, the circumstances of the workplace, and how suited the occupation is to different kinds of people. The prevalent practice of categorizing the personalities of people who work in the information and communications technology business is one of the most significant factors that contributes to the low number of people who choose to study or work in this field. The sector of information and communications technology is plagued by negative images and stereotypes, which are reinforced by the media. Many people are put off from pursuing a career in the information and communications technology sector because of the perception that it is a traditionally male-dominated industry. According to many people believe that working in this industry takes more of an aptitude for mathematics or reasoning than it does for reading, writing, or interacting with others. In addition, positions in information and communications technology have the reputation of being very technical rather than creative, of promoting obsessive and competitive behavior, and of demanding abilities that are impossible to acquire. In general, when people think of people who work in information and communications technology (ICT), they picture guys who spend long hours programming in social isolation in an environment that has been referred to as a "coke and pizza culture" [46]. According to Margolis and Fisher's findings, women are more sensitive to the notion that employment in information and communication technology are inherently solitary pursuits. ICT workers are typically thought to be Caucasian guys who have antisocial tendencies and who work in a career that is uninteresting and 'geeky'. In reality, however, ICT professionals come from many walks of life. In addition, according to The Australian Concise Oxford Dictionary, the term "geek" may be described as "a socially inept or boringly conventional or studious person" as well as "a computer expert; a computer fanatic." However, Margolis and Fisher indicate that a significant number of the students who participated in their survey were interested in a wide variety of topics other than ICT [47]. According to the findings of Goode, Estrella, and Margolis, students were unable to accurately or consistently characterize a computer scientist. This may be due to the fact that students have not interacted with someone who works in this industry, and as a result, they do not know what responsibilities come with the position. In addition, women were more likely to have the misconception that working in information systems entailed sitting in front of a computer and writing code, rather than gaining knowledge of emerging technologies. According to Hinds and Croft, who both agree with this statement, "there is very little awareness of the breadth and depth of the industry, the career options that are available, the jobs available to individuals, and the day-to-day activities that one would undertake" [47]. Despite this, Joshi, Schmidt, and Kuhn discovered that students' preconceived notions of information and communications technology (ICT) jobs do not change even when they get more knowledge about the industry.

2.3 Interest in academic achievements of students

Girls' sense of self-assurance and their interest in computer science increase at the same rate in elementary school. In elementary and middle school, the findings of the search reveal that girls are less confident in their scientific and computational ability than boys are [48]. Research shows that guys have a far higher sense of competence in the field of computer science than girls do [49]. In addition, when comparing girls and boys aged 11 to 14, we found that females reported higher levels of task difficulty and lower levels of self-confidence when it came to coding [50]. Gender disparities in coding skill do not always appear even in senior high school pupils (14–19 years old) [50]. While self-efficacy was positively correlated with interest, children who received programming education actually lost interest as a result [51]. That's why it's crucial to close the gender gap in computer science classes by giving more young women the chance to gain programming skills and experience.

Students who are interested in programming or who have a collaborative disposition may have more success with the programming empowerment. This research uses the term "interest in programming" to describe a person's psyche when they exhibit heightened focus, good emotions, or a persistent propensity for programming activities [52]. A student with a higher-than-average interest in a subject, such computer programming, is more likely to view that subject as important than a simple means to an end, as advocated by the self-determination theory of Ryan and Deci (2017) [53]. Instead, this student is really interested in the area and actively seeks out information about it. Furthermore, this student has a higher internal locus of causality than most [54], which means he or she thinks more highly of his or her own abilities to learn and perform the task [53] and perceives greater programming self-efficacy. In the face of difficulties, this type of learner is more likely to view the situation as a challenge, to understate the difficulty of the obstacles, and to persevere in order to find novel solutions [53, 54]. Students with a higher level of interest in programming have been found to have higher levels of programming empowerment [55]. This is because students with a higher level of interest in programming are more likely to see programming as meaningful, learn more about its impacts, and have higher levels of creative self-efficacy and programming self-efficacy. To sum up, a student with a stronger affinity for programming will gain a deeper understanding of the subject and a broader perspective on its significance. Those pupils who are more invested in programming tend to give it more weight than their peers. Those who are more passionate about programming are more likely to believe in its power [56]. Pupils who show a greater enthusiasm for programming also tend to have a more developed sense of their own creative potential. Students who are more passionate about programming are more likely to believe in their own abilities in the subject.

In this study [52], interest is defined not only as a discrete motivational variable but also as a psychological state that may be recognized by increased attention, focus, and emotion during interactions between individuals and the things that pique their interest.

The word "interest" may also be used to refer to a propensity that lasts for a longer period of time to return subjects that have already been investigated. It has also been claimed that there is a common thread that ties the formation of interest as a disposition with the frequent interactions that produce a psychological state of interest [57, 58, 59]. [60] addressed the concept of amplification, which refers to the process through which repeated exposure to the same high-quality stimuli can lead to a sustained sort of interest. Before moving on to an examination of the attributes of interest as a motivating variable, a cursory look will first be taken at several motivational theories that are founded on cognitive frameworks.

Particularly in the subject of computer technology, stereotypes may have a profound effect on how people operate. The search results presented imply that gender prejudices exist in computer courses, which can have a detrimental impact on both future course choices and grades. Some of the most important findings from the search are as follows: Computer science and gender roles: Internal validity of gender stereotypes in a computer science course was investigated in a recent research. According to the research, gender stereotypes indeed exist in computing classes and have an impact on students' impressions of themselves and the sector as a whole. The negative effects of stereotypes include impaired performance in the stereotyped group and, specifically, a gender gap in test scores between men and women on exams that are stereotypically associated with males. Belonging in a field might be hampered by preconceived notions about its gender compatibility; for example, the perception that CS is unsuitable for women. Females seem to have more positive preconceptions than males do, according to a recent research on gender stereotypes. However, unfavorable preconceptions forecast less interest in and performance in future computer science courses. Changing media portrayals and role models is one way to work toward more gender parity in the workplace and society at large. Women's underrepresentation in male-dominated disciplines and professions can be improved by recognizing and eliminating masculine defaults [12].

A high level of computer self-efficacy is a factor that influences the choice of whether or not to enroll in computer science classes in school [8, 49]. This factor is more prevalent in males than in females. The use of computers requires a certain level of self-assurance, which may be improved with early exposure to computing; nevertheless, girls lack pre-college exposure to computing more than their male counterparts do. PwC's research titled "Women in Tech" estimates that there are around 23% women working in the field of information technology in Kazakhstan [61]. The percentage of women that participate in athletic events is shockingly low. There is a presence of gender stereotypes in computing classes, and these preconceptions have the potential to influence students' self-perceptions as well as the popular opinions about the subject [12]. Students who identify as male report much higher levels of confidence in their abilities in the field of computer science. The articles that were used for this review represent published scientific literature on the topics of gender stereotypes in computing and on differences in coding classes at the high school and university levels that shape the stereotypes of boys and girls in CS along with the characteristics that are associated with both stereotypes. This review will focus on the topics of gender stereotypes in computing and on differences in coding classes at the high school and university levels. There is a significant gender discrepancy in enrolment in computer science classes offered to high school students, and this gap widens as students graduate from the basic level to more advanced topics [3].

Chapter 3

Methodology

3.1 Data gathered

Pre- and post-surveys were used to obtain quantitative data. The questionnaires were used to identify and investigate girls' opinions and perceptions of information technology, IT jobs, and stereotypes before and after participating in the demo programming lessons. The questionnaires were designed to determine the extent to which the demo programming environment influenced the girls' attitudes about IT. Questions were adapted from previously validated survey instruments [62, 63]. Survey questions include Yes/No questions (Table 3.1) and items using a 5-point Likert-type scale (Table 3.2). Scales referring as 1 = weak, 2 = below average, 3 = average, 4 = good, 5 = excellent. Considering that participants are primary school children we have changed 5-point Likert-type scale to emojis. See figure 3.1 A Likert scale is a psychometric scale that consists of numerous categories for respondents to choose from in order to show their ideas, attitudes, or emotions about a certain topic. In the discipline of second language acquisition (SLA), Likert-scale surveys have been used the majority of the time in examinations of individual difference factors including motivation, anxiety, and self-confidence. Likert-scale questionnaires have a number of advantages, some of which are as follows: (a) data can be gathered relatively quickly from large numbers of respondents; (b) they can provide highly reliable person ability estimates; (c) the validity of the interpretations made from the data they provide can be established through a variety of means; and (d) the data they provide can be profitably compared, contrasted, and combined with qualitative data-gathering techniques, such as open-ended questions [64].

Figure 3.1: Emoji based Likert-type scale

No	Survey Questions
1	Did you enjoy the lesson?
2	Has your confidence with computers improved?
3	Have your ideas about girls and computers changed?
4	Would you choose ICT to study further?

Table 3.1: Questions requiring a Yes/No response.

Data collection took place in 3 schools in rural area. Focus groups were 3rd and 4th year students. According to Lederman [65], a focus group is "a technique involving the use of in-depth group interviews in which participants are selected because they are a purposeful, but not necessarily representative, sample of a specific population, with this group being "focused" on a particular topic". Therefore, participants in this form of research are selected based on the criterion that they have something to say about the topic, fall within the age range, share

No	Survey Questions
1	I feel confident using computers at home
2	If something goes wrong on the computer I panic
3	I want to study computing
4	Computers are fun
5	I want to create more games
6	Studying with a favorite character was so much fun
7	How did you feel during lessons
8	How did you feel after completing the lesson
9	I feel confidence In ICT lessons

Table 3.2: Items using a 5-point Likert-type scale

similar sociodemographic characteristics, and are comfortable speaking to the interviewer and each other. The subjects investigated via free text replies in the survey and focus groups included the girls' computer confidence, their knowledge of an IT job, how they envisaged women convincing them to pursue IT careers, their reactions to the program, and their future interests in IT as a subject. Table 3.3 shows how many surveys were gathered and how many girls participated in focus groups.

Data type	**Participants**
Pre-survey	265
Post-survey	199
Pre-focus groups (6 conducted)	134
Post-focus groups (5 conducted)	108

Table 3.3: Summary of the data collected

A preliminary survey was carried out in order to gather information regarding students' levels of self-assurance and interest in ICT classes, in using computers, and in questions about whether or not they choose smartphones over PCs and whether or not they favor game-simulated lessons. As a direct consequence of this, we have discovered that the gender composition of the class varies according to the teachings. After participating in a one-month trial program, the post-survey questions focused on eliciting respondents' experiences. A survey has been carried out on a weekly basis in order to assess the development of the learning process.

3.2 Data analysis

Confidence and interest level was the summation of responses to the questions that are demonstrated in Tables 3.1 and 3.2 We used the Statistical Package for the Social Sciences, often known as SPSS, in order to conduct the analysis of the quantitative data and the calculation of the correlation. A well-known piece of software for statistical analysis is called Statistical Package for Social Sciences, or more often referred to as SPSS. It is one of the most well-liked tools in current statistical research because of its user-friendly Graphical user interface and large array of capabilities, including add-on modules and add-on packages like Amos

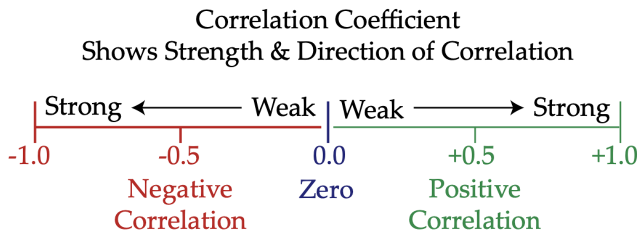

Figure 3.2: The correlation coefficient spectrum (from -1 to +1)

and Clementine. In addition, it is one of the most widely used tools in the field. Since its inception in 1968, the Statistical Package for the Social Sciences (SPSS) has seen extensive use across several industries and academic fields. [66]. NVIVO was used to code all of the qualitative data, including the free-text replies in the surveys, and then it assisted with the analysis of all of the qualitative data. NVivo is a CAQDAS application. The applications that make up CAQDAS provide assistance to qualitative researchers in the areas of data gathering, organization, analysis, and visualization, as well as report writing. CAQDAS systems, on the other hand, do not eliminate the need for human researchers; rather, they assist human researchers by offering a variety of functions and tools that may be used to organize and arrange the data that has been gathered. [67].

The term "correlation," which is also often referred to as "correlation analysis," is a word that is used to explain the relationship or association that exists between two (or more) quantitative variables. This strategy is based, primarily, on the idea that the quantitative variables have a connection that can be described as linear, which means that it follows a straight line. In the same manner that measures of association for binary variables do, it evaluates not only the "strength" or "extent" of a connection between the variables but also the direction in which the link points. An analysis of correlation will provide a correlation coefficient with values that may range from minus one to plus one. A correlation coefficient of 1 indicates that two variables are perfectly related in a positive (or linear) way, a correlation coefficient of 1 indicates that two variables are perfectly related in a negative (or linear) way, and a correlation coefficient of 0 indicates that there is no linear relationship between the two variables that are being studied.[68]. These are showed in Figures 3.2 .

Chapter 4

Discussion and Results

4.1 Results

We thought that girls' confidence had grown based on the findings of the before and post survey that we administered. In the post-survey, the girls were asked whether or whether their trust in information technology (IT) had risen, and if it had, how it had done so. The majority of the women who replied to this question reported a rise in their level of self-assurance, which corresponds to a percentage of 76%. 17 percent of the 67 ladies who answered "no" stated that they were already confident prior to taking part in the program. In addition, after taking part in the demonstration session, the girls reported feeling a significant reduction in their tendency to worry if something went wrong with their computer (p .001). During the focus group interviews that were carried out after the session, the girls were also questioned whether or not they felt more confident using computers as a result of having participated in the program; the majority of them said that they did. A matrix coding investigation found that there were 42 instances in which the women had self-reported that program had increased their confidence. The statements made by the women are evidence of this point. "After completing the course, I had a greater sense of self-assurance." "It felt like we were playing a game, and I can share my experience, which makes me feel smart." "If I found something wrong in my computer, I would have gotten scared, but here I think I know how to fix it."

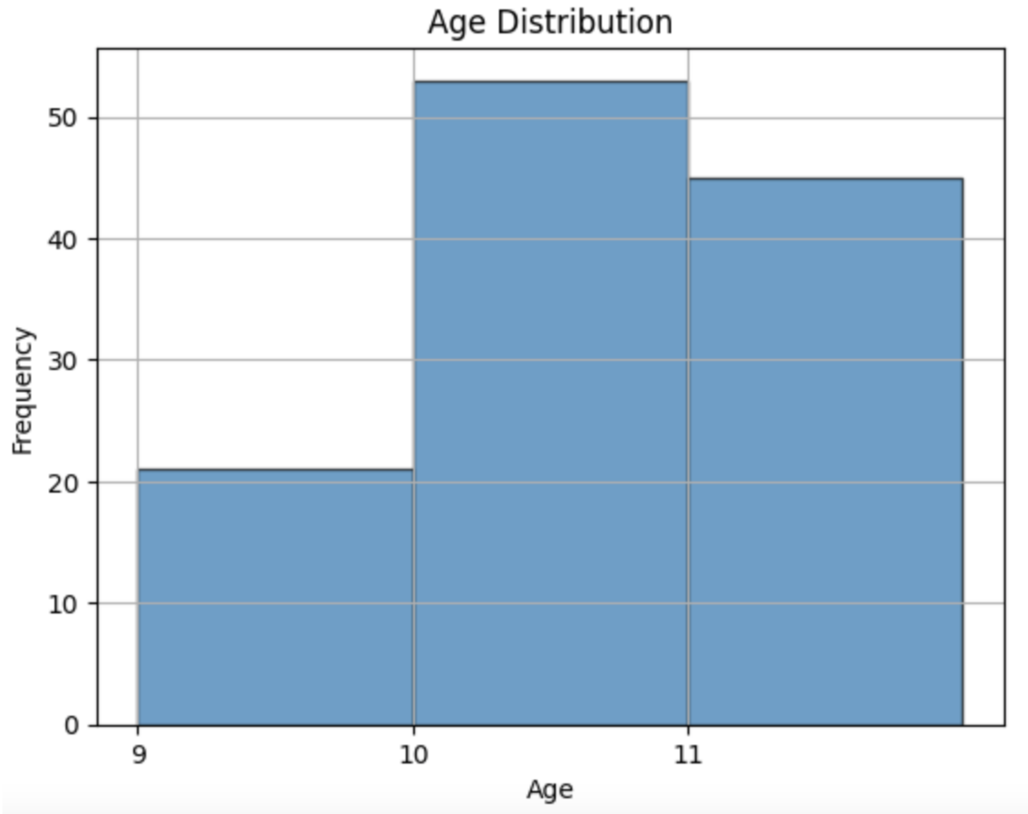

Figure 4.1: Caption

The second presumption that we made was that as a direct outcome of the training, women would have a heightened awareness of and interest in information technology (IT). In the pre-survey, there was a statement that asked respondents whether or not they would explore future IT studies. According to the statistics gathered before the focus groups began, the vast majority of the women who participated in Digital Divas had a negative attitude about computers and/or a career in IT prior to taking part in the focus groups. There were 100 unfavorable comments made, compared to only 15 positive responses, about stereotypes. This also applied to the results of the preliminary survey. A question about what the women want out of their careers in IT was posed to them.

53 of the 247 girls who participated in the survey gave the response that there was nothing about working in IT that they would love, that they would not desire a career in IT, or that they did not know or were unsure. This is a response rate of 21 percent. The research showed that 39% of the females either disagreed with the statement or strongly disagreed with it, with just 14% of the girls agreeing

or strongly agreeing that they desired to study IT more in the future. In the follow-up poll, the women were asked if they were interested in pursuing a career in information technology, and 17% of them said that they were.

Two of the hypotheses on the level of interest that women have in information technology were subjected to a t-test. A t test is a statistical test that compares the means of two groups. It is one of the most frequently employed statistical hypothesis tests in pain research [69]. The pre and post surveys had the same two statements: "I like to mess around with the computer," and "Using a computer makes learning more pleasurable." According to the data, there was not a discernible improvement brought about by the girls' involvement in the program. Nevertheless, in the follow-up study, the young women were questioned about whether or not their perspectives on the relationship between women and computers had shifted. The answer to this question was given as a 'yes' by 98 (or 51%) of the 193 female respondents.

After the focus groups were through, questions for further study either during or after school were discussed. A matrix coding investigation revealed that there were seven mixed comments, 12 negative comments, and 36 positive statements regarding the need for greater IT study. In addition, responses given by participants in focus groups that were held one and two years after the conclusion of the program indicated that those girls whose perspectives had been affected continued to have an interest in the topic.

As was said before, one further assumption we made was that the course material would pique the interest of young women in information technology. During the post-survey, the girls were questioned whether or not they valued their participation in the class (yes/no). Among the 198 ladies who responded to this question, 172 (87%) stated that they had found it enjoyable, whilst 26 (13%), stated that they had not. It should be underlined that despite the fact that the vast majority of the girls enrolled in the demonstration program voluntarily did so, some of the participants were assigned to the course in order to meet the minimum enrollment requirements or because there were no other alternatives.

The manner in which the girls described the show provides evidence of the

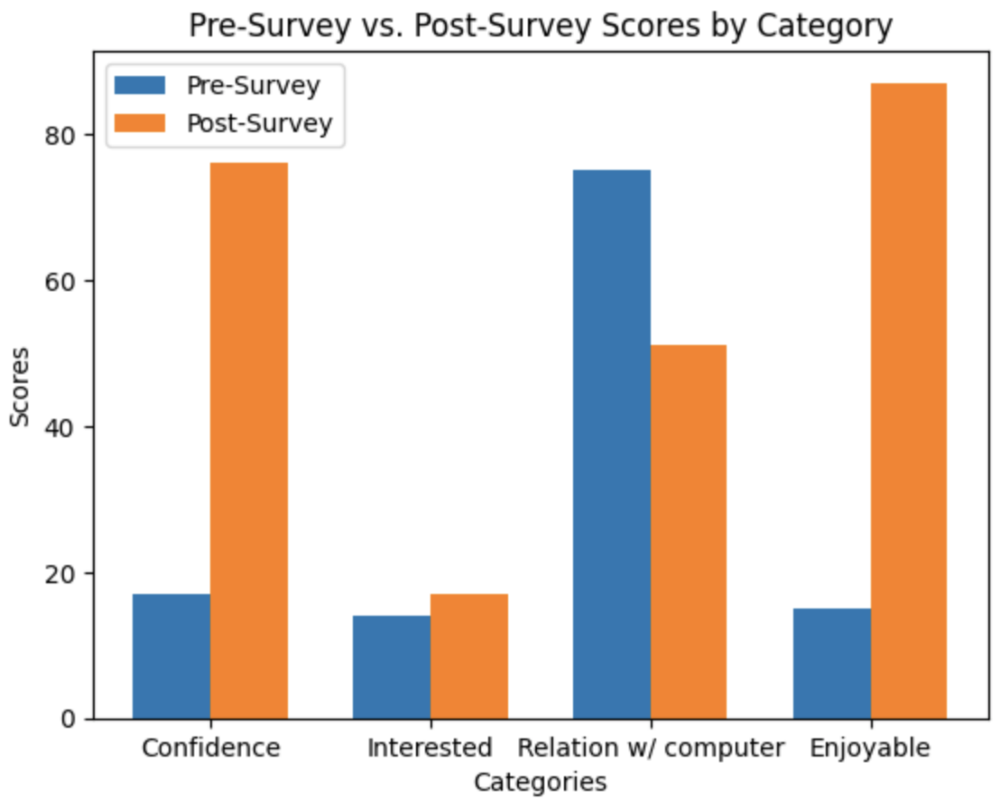

Figure 4.2: Highlighted results of pre and post survey

manner in which the contents captured their attention. According to the findings of an NVivo text search taken from the post-survey, respondents used the phrases "fun" and "enjoy" in a positive meaning to describe either the program itself or the content of the program 249 times. After conducting a text search on the data from the focus group, it was discovered that these terms had been used 190 times. The girls provided a variety of feedback, some of which included the statements "I learned more ways I can use the computer," "I enjoyed," "I had fun," and "I experienced that ICT can be fun and involve girls."

Stages	**Enjoyment level**
1 lesson	.3
2 lesson	.27
3 lesson	.31
4 lesson	.35

Table 4.1: Correlation of results with enjoyment for each stage of lessons

Tabel 4.1 shows the relation between stages of demo program and enjoyment level of girls. We can conclude that correlation is steady and show slight increase till the end of the program. However, we can see that on the second week of the demo program enjoyment level has been decreased. We assumed that it resulted from the change of the mentor for that very stage. Because Nvivo detected comments like 'i liked the atmosphere teacher creates' and 'this week teacher(mentor) was sad'.

Table 4.2 demonstrates correlation results related to confidence of girls in each stage of program. We can clearly see that after the first week of lessons confidence has increased after which it stayed pretty similar but nevertheless show some slight increase by the end of the month.

Stages	**Confidence**
1 lesson	.11
2 lesson	.34
3 lesson	.4
4 lesson	.45

Table 4.2: Correlation of results with confidence for each stage of lessons

Overall, we can assume that confidence and enjoyment has increased by the end of all stages. However, results are not high enough in order to state positive effect of program.

4.2 Discussion

It should not come as a surprise that the curriculum for teaching about technology is regularly recognized as an important topic in the research that has been done. [70] made the discovery that the reasons provided by females for not pursuing IT courses included the subject matter being improper for girls, the way the subject was presented in being boring, and IT subjects being dull. Modules in our curriculum were designed to encourage group work and, to the maximum degree that was practical, to incorporate some level of creative expression. This was done specifically with the goal of catering to what we believed to be the interests of women. The girls' confidence in using the computer was helped along by employing this strategy, which also served to guarantee that essential abilities were covered. The girls' reviews of the program were always very positive.

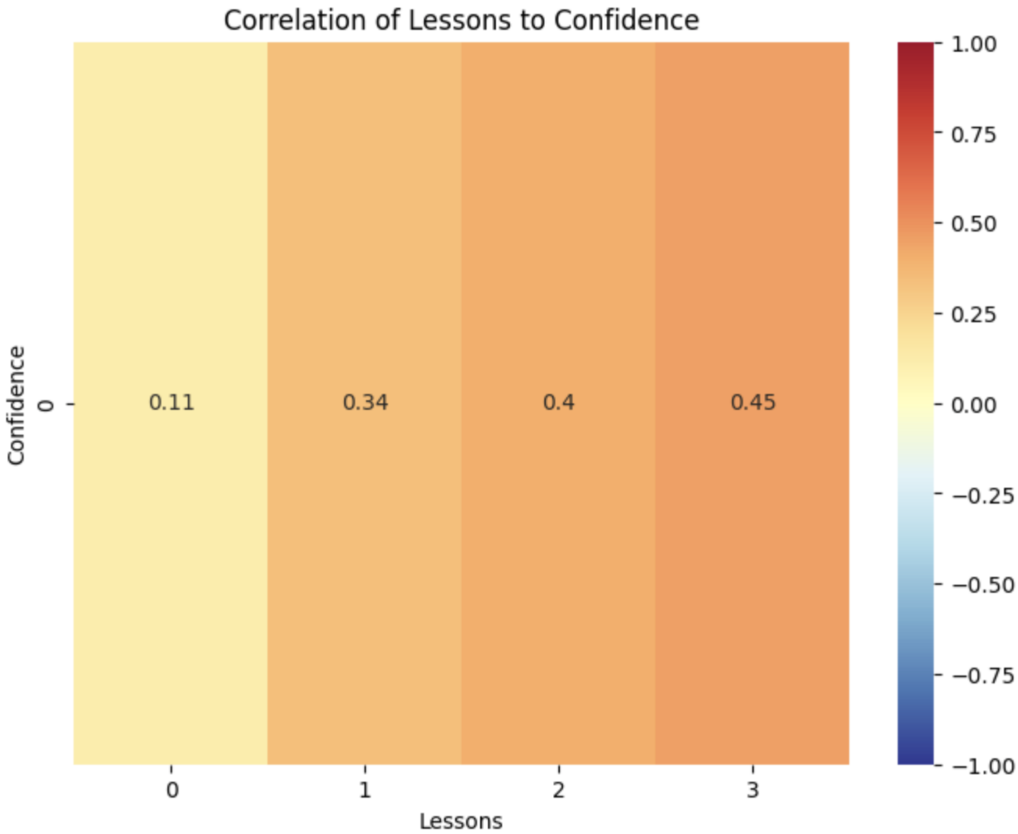

Figure 4.3: Correlation Heatmap

In order to evaluate the behavior of pupils in the classroom, I have served as an observer in several different classrooms. The practical portion of the test was successfully completed by the boys, while the theoretical portion was successfully completed by the females. While young men take pleasure in getting compliments, young women prefer to engage in conversation with a mentor or a peer. Girls like engaging in convoluted forms of social engagement. During the course of my research, I came to the conclusion that guys have a propensity to be more competitive with one another, but girls are more likely to work together. One possible explanation for this is because from an early age, they are subjected to the gender norms and expectations of society. Nonetheless, it is necessary to acknowledge and promote the qualities that are innate to each gender in the academic setting.

According to the findings of the preliminary poll, 99 students had no interest in information technology, whereas 15 students had a favorable attitude toward IT. The one thing that we can't overlook is the fact that, according to today's

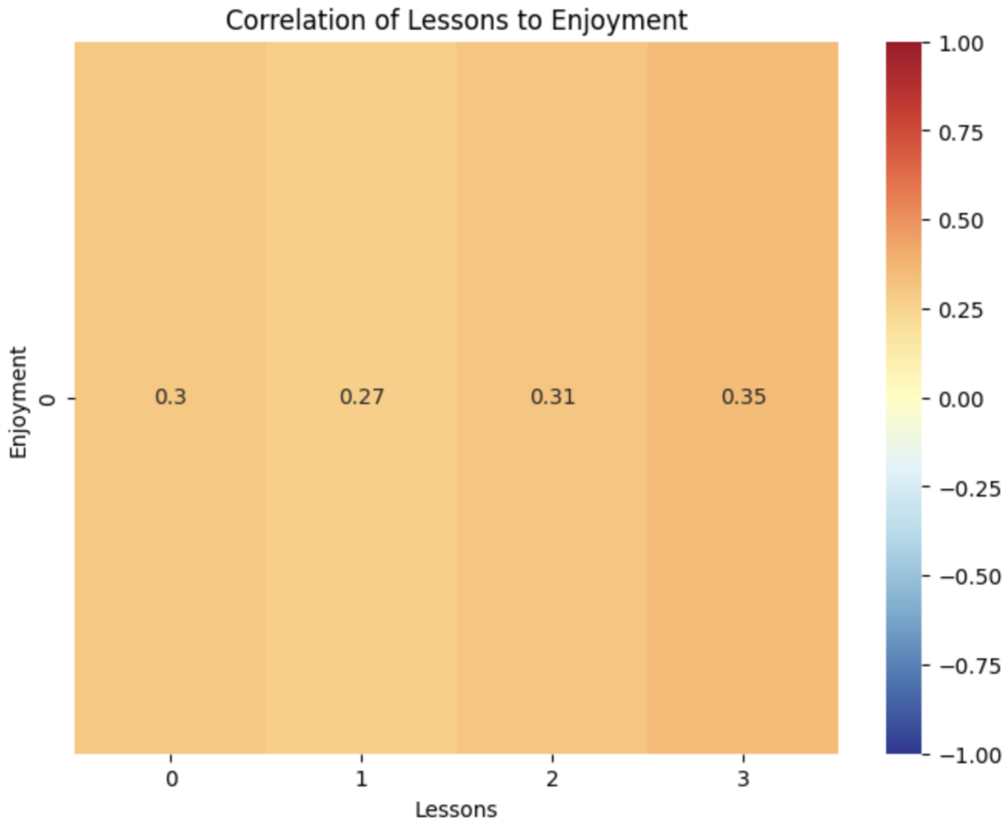

Figure 4.4: Correlation Heatmap

norms, kids are more likely to use their smartphones rather than laptops, and 100% of them do so. According to the findings, pupils would rather have lessons that are game-based or simulated than regular ones. According to the results of a survey, females are more likely to have a favorable association with video games that are themed on aspects of their personalities, including playing with their hair or playing beauty or food games. This demonstrates that females, beginning in their early youth, have a tendency to acquire abilities relevant to their inherent values, which eventually influence the choice of career path they make. On the other side, boys tend to favor games that help them increase their ability to think logically and critically, as well as their ability to respond quickly and make snap decisions. These are the kinds of games that are designed to be a part of the masculine portion of the world, which runs entirely counter to the ideals that the majority of girls hold. As a result, we may reach the conclusion that playing video games in childhood equips guys with the necessary information technology abilities, whereas girls develop their ability to cook, perform chores, and be creative.

Classroom
Everyone was incredibly nice to one another, everyone paid attention to the instructor, and the whole experience was really, really, really positive. Amusing and convenient both quite peaceful. (The absence of boys led to a reduction in noise) And you can probably anticipate what occurred next: when they gave oral presentations, you were able to hear them. It's like a friendlier atmosphere, and there aren't any boys messing about or anything like that, so it turned out to be a pleasant experience. I took an information technology class the year before, but it was primarily comprised of male students, and you just sat there thinking, "I don't want to put my hand up to need help." Indeed, everyone was really kind to one another, everyone paid attention to the instructor, and the whole experience was excellent in every way.
Learning is fun
It's more enjoyable when there are only females. It was just a group of females, you would chat to them, they were all aware of what we were discussing, and everyone was just delighted. It is great to get away from the rowdy lads and to have fun while working in a classroom full of girls. I had a great time and picked up a lot of useful information in the process. I also like being in a class with just female students.

Table 4.3: Students' reviews

The educational program: It should come as no surprise that the educational program for educating about technology is often highlighted as being significant in the research that has been done. According to the findings of Anderson et al. (2008), the reasons that females cited for not attending information technology classes included the beliefs that the material was not appropriate for girls, that the method the subject was taught was not fascinating, and that information technology classes were dull [70]. The modules in our curriculum were meant to foster group work and, to the greatest extent feasible, to integrate some degree of creative thinking. Our curriculum was carefully created around what we considered to be the interests of females. The girls' confidence in their ability to use computers improved as a result of this strategy, which also ensured that essential skills were covered. Positive reactions to the lesson plan came from the majority of the students, the females. The learning environment: [71] said in

Confidence
They boast and tear you down in a same manner. The reason for this is that there are only females participating; if there were males, they would take over and tell the females that they are doing something incorrectly. It bolsters our self-assurance, making it easier for us to speak up and share our perspectives. You wouldn't be able to convey what you want to say if there were male students in the class because they would be too busy talking amongst themselves. When you're among only other women, you feel more empowered to do new things. You feel more comfortable putting your hand up and saying, "I need help," because the boys will often respond by saying, "That person needs help." We are not going to do any job at all, and "Ha, that person definitely needs some assistance."
Learning environment
My guess is that it's just to get more work done when the guys aren't there because they have a tendency to be noisy and don't really pay attention to what's going on around them. The majority of the lads in the class were being disruptive, but we managed to get all of our work done. ESS may be quite distracting. When compared to a math or science class, there are males in this class who never stop chatting, and the teacher does not concentrate on you. I believe that working with boys slows down our progress. If there were males in the class, I'm quite sure I'd be more easily distracted. If I didn't already do it, I probably wouldn't participate as much as I do now. It is much simpler to concentrate on schoolwork when one's classmates are just other women.

Table 4.4: Students' reviews

their research that there is commonly an unconscious prejudice in the classroom, with teachers stressing that males are better and more natural with computers than girls are. This prejudice can have a negative impact on students' ability to learn. The schools embraced the concept wholeheartedly and insisted on holding sessions exclusively for female students. The comments in Table 4.3, 4.4 demonstrate that the girls in the class where there were only female students provided the most ecstatic response. Our findings highlight the importance of the setting within the classroom; all-girl classes made learning more fun, helped boost girls' confidence, and contributed to improved learning. The fact that many schools ran the program on many occasions is suggestive of a positive attitude seen in these institutions. The instructors were almost all female, with the bulk opting to work alone. There was just one male instructor. However, it was determined that the majority of the teachers, but not all of them, were initially enthusiastic about teaching the program, and that all of them were quite favorable towards the finish. This was established despite the fact that a comprehensive investigation of the instructors' responses was not feasible due to space limitations.

Interest in IT: The program was based on the primary premise that the girls' newly found drive and passion, which they exhibited after participating in the workshops, would be maintained over time. It would seem that there is no published research showing the extent to which an intervention program such as this one has been effective over the course of a longer period of time. We assembled 33 young women into 11 separate focus groups and held them at four different schools. Because of the low number of girls that we were able to contact and ask to participate in the focus groups, we are aware that we are unable to draw any definitive conclusions from this data. This is because of the limited number of girls that we were able to contact. The replies, on the other hand, do provide some insights on the degree to which the lessons learned from the case study were retained. The findings suggest that the program has continued to have a positive influence on those young women. Most of all, they recalled that the lesson was enjoyable, and they recalled the many activities that took place in the classroom. They also remembered information on the many job options available in the field of information technology.

It was very evident that the message that information technology (IT) is not exclusively for males had made its effect, and that whatever stereotyped notions of IT that they may have held had altered. For instance: "It's not only possible for guys; girls can do it, too." You are not required to spend all of your time sitting in front of a computer screen; instead, you have the opportunity to travel and pursue other interests. "In my opinion, women have the potential to make a more significant impact...they have a lot to offer in that arena." A few of the females have shown an interest in pursuing a career in information technology, while others are thinking about pursuing such a job. It looked that they had maintained their trust in making use of technology. My attention was piqued even more by it. Now that I am familiar with how to utilize specific applications, it raised it up a little bit further. I simply need to be a little bit more clear about what it is that I want to learn, I believe.

The program has had a lasting impact not just on the individual schools where it has been implemented, but also in the larger community as a whole. Schools continued to get in touch with the research team to ask questions about the program and how they might incorporate it into their curriculum.

Chapter 5

Conclusions and future work

5.1 Conclusions

Education in programming is becoming an increasingly crucial core ability in this day and age due to the rise of digital technology. Despite this, there remains a significant gender gap in the sector of technology, with women being significantly underrepresented. It is essential to involve young girls in primary school programming at a young age in order to close this gender gap. There are several factors affecting the vision and values of girls. In order to get attention of girls for programming they should get to know it early and feel the atmosphere to break the gender stereotypes. According to the findings of the study, it is possible to draw the conclusion that the demo program fro girls, which was designed to boost girls' self-assurance in information technology (IT), had a beneficial influence on the participants' sense of self-assurance as well as their attitude toward IT.

The findings of the preliminary survey suggested that a sizeable majority of the girls reported an improvement in their level of self-assurance as a direct result of their involvement in the program. This shows that special program for girls had a significant role in effectively contributing to the girls' increased confidence in their own IT skills and talents. In addition, the majority of the girls reported a decrease in the amount of fear they had regarding computer difficulties, which is evidence that the program assisted them in cultivating a connection that is more positive and comfortable with technology.

The research project hypothesized that participation in the program would pique the interest of young women in information technology; however, the results did not demonstrate any obvious rise in the participants' levels of interest. Despite this, it is interesting to note that a sizeable proportion of the girls reported having favorable feelings about computers and that they had joy in making use of these devices both before and after participating in the program. This shows that rather than directly impacting interest levels, Digital Divas may have just reinforced favorable sentiments that were already present in the audience.

In addition, the study came to the conclusion that the participants regarded the program material to be fun and engaging. This was demonstrated by the high number of female participants who stated that they found the program to be entertaining. The comments made by the girls underlined the joyful and uplifting experiences they had while participating in the program. This brought to light the fact that information and communication technology (ICT) may be entertaining and engaging to female participants.

The fact that the study found a correlation between girls' levels of confidence and enjoyment of working with information and communication technology (ICT) gives credence to the hypothesis that creating an environment that is exclusive to females and reducing the significance of gender differences can have a beneficial effect on girls' ICT-related accomplishments and their aspirations to work in the field.

Girls are more likely to feel comfortable and confident when they are free to express themselves and when they are able to explore ICT in an environment that is friendly and inclusive and has an all-girl vibe. Girls are more likely to actively participate in activities linked to information and communication technology (ICT), take risks, and acquire a feeling of self-assurance in their talents if the possible effect of gender stereotypes and prejudices is removed.

Girls are more likely to appreciate their experiences in information and communication technology (ICT) if they feel that their interests and talents are acknowledged and validated. Having fun is a crucial component in maintaining continuous engagement and motivation. It is possible to promote girls' enjoyment of activities using information and communication technology (ICT) by reducing the significance of gender disparities and cultivating an atmosphere in which they are able to freely express themselves. This will ultimately lead to better academic performance in the subject.

In addition, the good experiences and successes that may be achieved in an atmosphere with only other females can have a substantial influence on a girl's willingness to pursue a career in information technology. It is possible for girls to be inspired to seek a career in information technology (IT) as a feasible and fulfilling option when they see other women succeeding in the industry and challenging gender preconceptions. It is possible to boost the possibility that girls will show an interest in pursuing professions in information technology by creating an environment that is supportive of females and encourages them to explore their potential in information and communication technology (ICT).

It is essential to emphasize that cultivating an environment that is exclusive to females does not necessitate the exclusion of males or the continuation of gender segregation in educational settings. In its place, it seeks to create an environment in which young women may flourish and develop self-assurance in their capabilities, with the ultimate goal of contributing to greater gender equality in the area of information technology.

As a conclusion, the association between levels of confidence and pleasure implies that creating an all-girl culture and reducing gender inequalities may have a good impact on girls' successes in information and communication technology (ICT) and their willingness to pursue professions in IT. We can tear down gender barriers, promote equal opportunities, and cultivate a generation of self-assured and successful female workers in the information technology sector if we create settings that are inclusive, empower girls, and affirm their interests and skills.

In general, the data show that the results of the demo program was successful in contributing to enhancing girls' confidence in IT and providing a learning environment that was both positive and pleasant for the participants. Even while the program may not have directly boosted interest in IT, it did promote good attitudes and give females opportunity to investigate and work with technology in a nurturing environment. These findings highlight the relevance of initiatives like Digital Divas in boosting female participation in the field of information technology and empowering girls to pursue careers in this industry.

5.2 Future work

The continuation of the creation and execution of specialized programs and initiatives aimed at boosting information and communications technology (ICT) among elementary school girls is one potential direction for future work. These programs may place an emphasis on supplying females with hands-on experiences, role models, and chances for mentoring that motivate and enable them to explore and achieve in the field of information technology. We can further stoke the fire of girls' interest in technology if we design these programs to be specifically catered to the unique requirements and pursuits of young women. Integration of diverse and inclusive depictions of women working in technology across a variety of instructional materials and forms of media is an additional key area of work that will be done in the future. We are able to challenge preconceptions, widen girls' views, and motivate them to see themselves as future leaders in the area of information technology if we bring attention to the accomplishments and contributions made by women in IT who come from a variety of cultural and ethnic backgrounds. In addition, continuous efforts should concentrate on developing chances for women in the information technology sector to engage with professional networks and industry leaders. Mentoring programs, internships, and industry partnerships may give females with vital exposure and practical experiences, so confirming their interest in, and confidence in pursuing, careers in the information technology sector.

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Appendix

```
import pandas
import seaborn
data = read dataset
correlation = calculate corr()
heatmap(correlation_matrix)
show()
```