STUDENT CHOICE IN CONTINUING TO STUDY HIGH SCHOOL SCIENCE

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CERTIFICATION OF PROJECT WORK

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Abstract

This study implemented a quantitative approach to examine the factors that affect whether students continue to study science at the high school level. Data was collected through closed-ended surveys to answer the research questions: 1) "What factors impact a female student's choice to continue to study science at the high school level in Saudi Arabia?"

This research took place in Najran city in Saudi Arabia. The sample for this research study consisted of 148 female high school students, aged 16 to 18. Stratified sampling was appropriate for the nature of the study because it aimed to include female survey respondents. The participants in this research study were 26% first-year students, 52% second-year students, and 22% third-year students. The research instrument that was utilized was the "ROSE (The Relevance of Science Education), which is a questionnaire mostly consisting of closed questions with Likert scales" (Schreiner & Sjøberg, 2004, p. 35).

After data was gathered, the responses of each participant were analyzed and given a point value based on a scale from 1 to 5. The obtained data was translated into graphs and tables in order to provide a comprehensive and easy-to-understand presentation of the data for in-depth analysis. This study concluded that the main factors that contribute to the female students' desire to continue studying science in high school are interest, attitude, and motivation. Also, it can be seen clearly that affective factors influence students' learning. Lastly, the researcher suggests recommendations for future research.

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Introduction

Research Question

Scientists are concerned about the lack of student interest in studying science (Dillon & Manning, 2010). Sometimes students have a difficult time in studying science because teaching methods may inhibit the preservation of information after studying science. Chemistry, biology and physics are unique content areas that require the teacher to integrate a unique language to enable clarity concerning the present information. Since student voice is often absent in the educational process, the main focus of this study will be on students' perspective about science class, in an effort to answer the research question "what factors impact a female student choice to continue to study science at the high school level in Saudi Arabia?"

Statement of the Problem

Despite Canada's students achieved the top scores in mathematics and science, the quantity of students, even there, that express interest in studying science has dropped and is accompanied by the deteriorating performance in education (Kennepohl, 2009). The motivation for propelling students toward indicating interest in studying science is linked to the present number of qualified science teachers willing to commit their efforts toward their responsibility and duties (Mansfield & Woods-McConney, 2012). So, the interest in studying science can be discouraged when students fail to communicate with the teachers who cannot initiate an extraordinary method of interacting with the class. Hence, the absence of inquiry-based learning makes the study of science a concern in relation to the performance of the students. In addition, when students have an interest in studying science their academic performance can be impacted because the learning results are a product of teachers whose desire is to discover appropriate techniques for distributing knowledge (Neff et al., 2010). Thus, the lack of using evidence-based

teaching techniques in teaching science could hinder the potential learning approaches that attract the interest of the students.

> "In recent years, many studies have highlighted an alarming decline in young people's interest for key science studies and mathematics. De- spite the numerous projects and actions that are being implemented to reverse this trend, the signs of improvement are still modest. Un- less more effective action is taken, Europe's longer term capacity to innovate, and the quality of its research will also decline". (High Level Group on Science Education, 2007, p. 2, as quoted in Science teachers, science Teaching, Dillon and Manning (2010).

The teaching techniques applied in classrooms are often archaic. In addition there is a wide range of content that should be completed within the certain allocated periods of time (Quigley, Marshall, Deaton, Cook, & Padilla, 2011). Teacher will often deliberate on the struggle to accomplish the course objectives while pressure mounts to engage the students. Most education systems rely on the general curriculum that is interpreted into their individual perception and applied accordingly. When this occurs, the students can have a difficult time adapting to the teaching methods, resulting in poor educational performance.

There have been negative attitudes among students when interest in studying science is involved for a prolonged period due to such cognitive ability reduces the possibility of creating a breakthrough in the learning process (Dillon & Manning, 2014). Most students believe that studying science will lose its significance after they complete their studies and pursue their careers. This ideology materializes because they follow the experiences of former students.

Furthermore, the personal reflection of a student can influence their potential in developing an interest in studying science. Students oriented to gain knowledge about science will dedicate their time and effort in their course work because they desire to be responsible in life. Studying science can assist students' progress in their profession of choice and participate in achieving individual ambitions in society (Jenkins, 2006).

Purpose of Study

Studying science is a significant tool in molding the social, political, and economic environment. The students should strive for proficient knowledge in science courses if they desire to create an impact in their lives. Learning more about science allows the students to make informed decisions within both the education system and external environment. Studying science also helps the students to be aware about their health and ensures they sustain their welfare (Jenkins, 2006). However, there are some factors such as science teachers and the science curriculum affecting students' decisions to study science or not. Both of these factors can influence the construction of student identities and affect their interest toward studying science.

It is important to make the study of science interesting among high school students in order to shape a diverse society that is prepared to address challenging issues (Mansfield and Woods-McConney, 2012). Science stories can help teachers with their teaching standards (Koch, 2012). Science stories are designed to encourage them to restructure their teaching techniques in an attempt to provide the learner with a better chance of developing an interest in studying science (Koch, 2012).

As a science educator, it is essential to have a high interest in studying science because it seeks to alter the attitude of students and motivate their efforts toward enhancing their learning experience and performance (Mamlok-Naaman, 2011). The possibility of developing new

teaching programs will promote collaboration among students. Therefore, identifying significant reinforcements and employing incentives can sustain the study of science among students.

The aim behind this study is to determine the reasons of why female students have lack of interest in studying science. Also, to examine what factors impact a female student's choice to continue to study science at the high school level in Saudi Arabia.

Literature Review

Recently, educators and researchers have begun to pay significant attention to the pertinent factors that enhance students' educational outcomes. An increasing body of empirical literature suggests that a combination of environmental and psychological characteristics influence academic outcomes. Science subjects present a considerable challenge to students and science teachers. Studies indicate that these challenges result from lack of intrinsic and extrinsic motivation to learn science.

Lack of Student Interest in Science

Many research studies have been carried out to investigate the reasons for students' disinterest in science subjects. Most of these studies found attitudes and environmental factors as the primary components that affect the learning of science subjects among students. While, the other factors include teaching style, curriculum, and institutional changes.

Science, being one of the most important subjects in school and college curricula, has remained an interesting topic of research for years. Researchers have always emphasized developing positive attitudes and interest of students in learning science subjects. The majority of studies have focused on pedagogy, content, and curricular issues. Hofstein and Mamlok-Naaman (2011) concentrated on improving the interest and attitude of students towards learning chemistry at the upper school level. Three key factors were identified that should be considered

to enhance the interest and attitude of students. These factors include the presentation of content (historical approach and relevance), instructional techniques, and gender issues. There were certain areas identified that should be the focus of science educators, chemistry teachers, and curriculum developers to promote positive attitude among students towards learning. Science and chemistry teachers need to apply a particular pedagogical style, while curriculum developers must include historical science approaches in the curricula (Hofstein and Mamlok-Naaman, 2011).

Yang (2010) interviewed 24 college students to gain an understanding about their experiences and ideas about science. The researcher examined interest levels of the students in science subjects from four different aspects. These aspects included learning science concepts in school, learning science concepts outside of school, interest of perceiving scientific knowledge in school, and interest of perceiving scientific knowledge outside of school. Qualitative analysis was conducted for testing the interest levels of students in science subjects from these aspects. It was found that students had different levels of interest in each aspect of science. It was observed that most of the students who perceived themselves as uninterested in science subjects had an interest in some areas aspect of science. The lack of interest of students in science subjects were found to be due to the pressure from school and forced learning curriculum (Yang, 2010).

Riess (2000) proposed a compensatory program for the German Science Education. It was aimed at raising the level of science education in Germany to meet the international standards. It was observed that students have lack of motivation and interest in science subjects, especially physics. They have a poor level of understanding of scientific concepts, methods, ideas, and results. These factors were raising scientific illiteracy among the German population and declining the power of decision-making in technological and scientific projects. Riess (2000)

emphasized improving the curriculum of science subjects based on the philosophy and history of science. The study also focused on the empirical results concerning knowledge and motivation of students towards science subjects. It was observed that the curriculum of science subjects at German schools was not influential; rather, everyday experiences were more helpful and better sources of information for students (Riess, 2000).

Osborne, Simon, and Collins (2003) observed that science educators need to learn much from the growing literature related to study of motivation among science students. The educators need to explore the intrinsic and extrinsic interests of students, as good teaching stimulates engagement and interest in students. It was observed that students desire more opportunities for practical work, discussion, and extended investigations in the sciences. However, there is limited research being done to identify the style and nature of teaching and attitudes that could engage students towards learning science (Osborne, Simon, and Collins, 2003).

Trumper (2006a) explored factors that affect the interest of junior high school students in physics. The opinions of science students were collected to understand students' views on science classes, their approach towards science, and out of school experiences in physics. The results found neutral interest of students in physics, but negative views regarding science classes. These results contributed into developing an effective course curriculum in primary and junior high schools. In addition, in-depth analysis of the students' opinions led researchers to formulate behavioral, curricular, and organizational changes (Trumper, 2006a). Similarly, Trumper (2006b) also collected views of students regarding biology. The overall interest of students towards learning biology was positive. However, the girls showed a greater positive interest than boys.

Christidou (2011) studied the relevant literature on students' interests in science; students' attitudes and images of science and technology; and differentiation based on culture,

gender, and socioeconomic status. The study highlighted vital outcomes through examination of the views of students and educators. It emphasized curriculum, teaching style, and students' attitude towards science subjects. By focusing on these factors, gender issues (stereotyping) in learning science subjects can be resolved. Moreover, better teaching styles can be identified (Christidou, 2011).

The Role of Science Teachers

Education of sciences is significant to the success of countries, specifically in the need to address growing issues of competitiveness between countries and to create sustainability (Olasehinde & Olatoye, 2014). The role of teachers is to create interest, provide knowledge, build motivation, and strive to overcome pre-existing barriers to student perceptions of the field of science (Sundberg & Ottander, 2013). Teachers must strive to create opportunities and interest in science through educational practices that focus on areas such as learning, motivation, and behavioral theories that enable the teacher to reach more students successfully (Tytler, 2002). When interest in science is enhanced among students at a younger age that will help them to have motivation and achievement in the future (Kazempour, 2014).

In addition, teachers are able to assess prior knowledge; creating building blocks of learning that promote a strong foundation in sciences and builds on prior interest in the field (Albion & Spence, 2013). Learning occurs at many levels for students, including learning based on prior knowledge, learning styles, and motivation (Akyurek & Afacan, 2013; Albion & Spence, 2013; Mesa, Pringle, & King, 2014; Kablan & Kaya, 2013). The role of teachers is to determine what preconceptions students bring to the classroom, their learning styles, levels of engagement necessary for success, and methods for promoting future learning (Sundberg &

Ottander, 2013; Albion & Spence, 2013; Kablan & Kaya, 2013). However, teachers are not equally motivated to meet these goals (Guzel, 2011).

Another important aspect of role of science teachers is to understand students and the way they think. Levin and Richards (2011) propose that all teachers have experience and knowledge of attending to student thinking, addressing their concerns, and recognizing the student perceptions and knowledge. Substance of student thinking is critical to understanding how the student is learning, what aspects of the processes are not being understood, and where thought processes may lead students to greater understanding of the topic (Levin & Richards, 2011). Also, these are directly associated with learning styles, which can promote success in the student when the different needs of the student are meet (Kablan & Kaya, 2013). Teachers must uncover the different student needs and be prepared to address them (Levin & Richards, 2011).

While teachers are critical in the success of students in schools, the school itself must also be supportive of learning and of teachers (Ateş & Artuner, 2013). Many researchers identify the needs of teachers as being important to creating the best work environment that can promote increased learning and desire to be successful in the field. In this way, schools provide a critical role in the success of science teachers. The areas most influenced by the roles of school include the appointment of teachers, availability of teacher development programs, access to tools, and self-actualization opportunities for teachers (Hand, 2011). According to Gunbayi (2007), organizational climate directly influences "teacher behavior – disengagement, hindrance, spirit and intimacy" as well as "behavior of the principle – aloofness, production, thrust and consideration" (p. 71). Thus, creating motivation in students requires that teachers have access to improvement opportunities through the school, including collaborative partnerships, "networking, mutual learning, and sharing of strategies and resources" with other science

educators and access to tools such as technology for use in the classroom (Duran, Runvand, & Fossum, 2009, p. 21).

Moreover, teacher efficacy is directly associated with the attitudes of students and the management of classroom students and learning content (Mansfield & Woods-McConney, 2012). Schools must focus on providing the most appropriate and successful work environment for teachers, in order to promote their ability to be successful in the classroom and to increase teacher motivation in engaging students successfully (Kazempour, 2014; Hand, 2011; Ateş & Artuner, 2013). Hence, successful teachers are motivated by both intrinsic and extrinsic rewards, which include creating opportunities for job satisfaction (Şerbănescu, 2013). Also, teachers demonstrate productivity when students are successful in achieving the goals of education and meeting the standards required (Sojourner, Mykerezi, & West, 2014). So, the roles of teachers are closely related to the roles of schools, and supportive schools promote strong teachers.

Furthermore, motivation of students is also related to the motivation of the teachers (Kazempour, 2014; Hand, 2011; Ateş & Artuner, 2013). Positive school environments begin with policies and support for teachers, which must include the ability to gather support in developing engagement in students or understanding different student needs (Kazempour, 2014; Hand, 2011; Ateş & Artuner, 2013; Duran, Runvand, & Fossum, 2009). Also, many studies indicate that experienced teachers may have valuable knowledge to share with new teachers; in addition, all teachers have unique experiences that can be shared to provide more successful teaching experiences. Therefore, schools should work to provide motivation and learning to teachers in order to help them provide these same things to the students (Gunbayi, 2007).

According to Dillon and Manning (2010), science teachers occupy a distinctive position in schools. The work of science teachers not only involves the teaching of purely academic subjects, but also often involves instructing students on complex practical skills that deal with safety and health issues (Dillon & Manning, 2010). For instance, science instructors are required to train students on the use of strong acids and bases, fire equipment, scalpels and other dangerous equipment and chemicals. This occurs against a background of limited first aid training or equipment (Dillon & Manning, 2010). The allegiance of science teachers to their scientific background contributes significantly to their identity and attitude towards the science course (Dillon & Manning, 2010).

The distinction between science teachers and other instructors can influence the way they interpret the science curriculum and how they perceive their career needs (Williams & Williams, 2011). According to Williams and Williams (2011), the role of teachers has shifted from programmed dispensers of knowledge towards managers of student learning and the overall learning context. Therefore, teachers should be well equipped to apply professional skills in the classroom environment in order to achieve the desired goals, including motivating their students (Williams & Williams, 2011).

Motivation and Learning

Motivation is an important part of the learning process that teachers should work to increase in their students and classrooms (Williams & Williams, 2011). Motivation is defined as a power that enables people to excel and overcome challenges to create change (Tohidi & Jabbari, 2012). In regards to science and student motivation, the ability of a student to actively engage in the tasks required for a complete or “better” understanding of the curriculum is

directly associated with the motivation of the student to accomplish this goal (Cavas, 2011, p. 32).

Thus, there are two main types of motivation in classroom settings: intrinsic motivation and external motivation (Gherasim, Mairean & Butnaru, 2012). Intrinsic or internal motivation is the level to which a learner's engagement in classroom learning is influenced by internal motivational factors (Lou, Lin, Shih & Tseng, 2012). Typically, students possess varying levels of internal and external motivation in the learning process (Lou, et al., 2012). The most influential intrinsic motivational factors include: curiosity, students' participation, challenges in a particular topic, and social interactions among peers (Williams & Williams, 2011). As conceived by Williams and Williams (2011), the most pertinent factors to positive student outcomes in science include the student's degree of motivation to obtain subject knowledge.

External motivation occurs when external interests, like earning good grades, peer acceptance, or teacher approval, determine classroom learning (Gherasim, et al., 2012). Rather than coming from inside the learner, through his or her own interest in the subject (as in intrinsic motivation), external motivational factors include recognition in the academic society and compliance to other people's expectations, which come from outside the student (Williams & Williams, 2011).

Studies indicate that there is a much stronger positive correlation between intrinsic motivation and student academic achievement in science subjects. According to Sesen and Tarhan (2010), internally motivated learners display persistent efforts and adaptive emotional responses even after failing, and while external motivators can help moderate academic outcomes and compensate for a lack of intrinsic motivation to learn, students that are motivated

solely through external motivators, such as grades, typically show much less positive academic outcomes (Gherasim, et al., 2012).

On the other hand, perceptions of students, regarding education and motivation, are determined by research to be a direct factor which leads to increased likelihood that a student will work hard and dedicate energy and time to a subject, in order to complete it successfully or to excel within the classroom (Tohidi & Jabbari, 2012). Different students may have different needs for developing motivation, such as the intrinsic or extrinsic motivations, and all students may have different levels of success in motivation based on emotional intelligence (Cavas, 2011). Self-efficacy can be used with active learning strategies and goals to assess the success of students in regards to the relationship between motivation and science achievement (Cavas, 2011). The belief in oneself, self-efficacy, is necessary to build confidence and to promote interest in a subject (Cavas, 2011). Thus, students with lower self-efficacy may be challenged by classwork, before seeing the work, as a result of prior experience with failure, or preconceptions of the difficulty or the class materials (Yurt & Sünbül, 2014).

Also, student motivation to learn may be directly related to attitudes towards science, which are developed by preconceptions of the field or the subject and coursework (Olasehinde & Olatoye, 2014; Tohidi & Jabbari, 2012; Cavas, 2011). According to Olasehinde and Olatoye (2014), student attitudes are related to the ability of students to find a subject interesting or engaging. Engagement in material is perceived as promoting success in the work, and in developing motivation to learn more about a particular area or subject (Ravenel, Lambeth, & Spires, 2014). Several studies in motivation and engagement clarify that students with higher engagement in classes have a marked improvement and more motivation to be more successful

and achieve higher scores in the course-related testing (Olasehinde & Olatoye, 2014; Tohidi & Jabbari, 2012; Cavas, 2011).

Olasehinde and Olatoye's (2014) study also indicates that attitudes towards science did not guarantee that the student would have higher science achievement in testing, while another study states that motivation in academic achievement is directly associated with the attitude towards the subject and material, which could improve upon the scores of students (Olasehinde & Olatoye, 2014; Onen & Ulusoy, 2012). A study with 500 students in secondary schools of Ankara realized that students' motivation was linked to the attitudes they had regarding chemistry, and their personal interest in the subject itself (Onen & Ulusoy, 2012). In addition, chemistry interest has been found to be reduced during recent years, and engaging students in completing this subject successfully can be challenging for teachers without the skills to promote motivation and engagement in the classroom (Faria, Freire, Galvao, Reis, & Baptista, 2012). Some of the methods for engaging students in this area may include hands-on techniques, such as problem solving and experiments (Faria, et al, 2012; Olasehinde & Olatoye, 2014; Onen & Ulusoy, 2012).

Moreover, problem-solving techniques can increase motivation, as shown in Adesoji's study (2008), after training in the problem-solving technique procedure (PTSP), where results from an attitude assessment demonstrated that the problem-solving technique resulted in increased interest by the students in Nigeria. Problem-solving techniques involve providing students with a specific problem that must be solved, such as through a project or essay, where the student must gather the relevant information in order to be successful in the completion. In addition, the PTSP technique allows students to critically consider the different methods for obtaining the information or in resolving the specific problem. Critical thinking skills can be

developed using PTSP, which makes this method of teaching valuable for the future of each student as well (Adesoji, 2008).

A study of Turkish students has explained a direct correlation between motivation and science attitudes as well as science achievement (Cavas, 2011). In addition, a study in Portugal demonstrated that engagement of students increased interest in learning about the subject, specifically in learning information that was beyond that of the curriculum and the more simplified requirements of the specific assignment (Faria, Freire, Galvao, Reis, & Baptista, 2012). To sum up, Motivation and engagement have been found to be critical in developing interest in a subject. Students interested in a subject are often likely to continue to work to learn more about it, and potentially improve upon achievement in the future.

The Role of Teachers and Motivation

Many teachers want to see the students in their classroom achieve classroom goals and engage in the information provided; however, not all teachers understand how to make this happen in the classroom (Wan Yunus & Mat Ali, 2012). Success of students is dependent on the success of the teacher, including on the teacher's confidence, work motivation, efficiency, and job satisfaction (Cristina-Corina, 2012). Many different problems can reduce the success of teachers in creating the strong classroom environment necessary for fostering student success in science (Kazempour, 2014; Hand, 2011; Ateş & Artuner, 2013). Some problems teachers are challenged by are only solved by the intervention of the school systems in which they work; however, some challenges are also in the education that teachers receive (Wan Yunus & Mat Ali, 2012). Experience and education may create different needs in teachers, which creates an opportunity for new and experienced teachers to work together to share knowledge and build

information that can be critical to the success of future teachers and students (Cristina-Corina, 2012).

One specific risk in the classroom is boredom, which is a risk for students and teachers, as this can directly influence the success in the classroom. Randler, Hummel, Glaser-Zikuda, Vollmer, Bogner, and Mayring, (2011) demonstrated the influence of boredom from a study of South-Western Germany 5th and 6th grade students, which found that interest, well-being, and boredom were three dimensions that were entangled with students' success. Furthermore, the research from Randler, et al. (2011) used motivational theory to evaluate the success and failures of respondents, noting that the success of students, in regards to intrinsic motivation, is measurable and that the instrument tested was valuable,. This study also demonstrated the importance of situational interest on motivation in regards to science (Randler, et al., 2011). When developing motivation, teachers must engage students using a variety of methods that are designed to meet the needs of all the students, or to highlight the specific learning styles of each student without ignoring that of others (Randler, et al., 2011).

In addition, teachers can create motivation by engaging students, such as by using the PTSP technique, which improves interest in the subject (Adesoji, 2008, p. 23). Engagement involves creating interest, involving students in the learning process and in the information or curriculum of the classroom (Faria, et al., 2012). Problem solving is designed to engage students by creating a relationship with the contents in a way that increases the ability of the student to apply information (Faria, et al., 2012). Additionally, students seeking answers engage with the content in a problem-solving way that requires active roles in learning (Faria, et al., 2012). Active roles are found to create lasting impressions, due to the level at which students must engage with the materials, such as through hands-on activities – bridge building, chemistry

experiments, or plant growing (Faria, et al., 2012). Implementation of problem activities that require students to seek out solutions, such as by using technology, can improve upon the success of knowledge sharing (Turkmen, 2006). Active engagement does not require that students build something, but it does require that students must actively participate in the learning process, including by seeking the necessary information through inquiry, including using technology to facilitate the search (Turkmen, 2006; Faria, et al., 2012).

However, engagement with materials is not the only type of engagement that must occur for the classroom to be successful; student engagement with teachers is recognized as essential to the learning experience for many students (Turkmen, 2006; Faria, et al., 2012). Teacher engagement requires that teachers meet specific needs, and these include the requirements of teachers to be friendly, approachable, and engaging with students in order to create the best environment for learning (Shahmohammadi, 2014). Teacher behavior has been found to be directly linked to the success of students since prior to the 1980s, and is largely studied for the influence it has on achievement (Brophy, Good, & Michigan State Univ., 1984). Behavior is also important due to the relationship with communication. In a study regarding teacher attitudes and communication, Pekel, Demir, and Yildiz (2006) demonstrated that communication and attitude of teachers is critical to student success, according to student evaluation of teachers in regards to the subject (Pekel et., 2006).This area can also be assisted by the knowledge of student previous conceptions of the subject taught, such as perceiving science as a strictly cold profession, void of people, and existing only in a laboratory (Pekel et., 2006).Teachers can build relationships that demonstrate the personable aspects of science as well (Pekel et., 2006).

Also, student perceptions are directly influenced by teacher beliefs. Teacher beliefs are important to the success of teaching because they provide power and motivation to the teacher in

regards to successfully sharing of knowledge (Gardner & Jones, 2011). In this way, the ability of the teacher to create interest in the subject comes from the teacher's belief in the subject itself, which contributes to the interest of the students (Brophy & Good, 1984). This is an aspect of leadership, and teachers are leaders that guide their students to the success of learning the concepts in their classroom and course materials (Brophy & Good, 1984). Science teachers "represent the major link between the curriculum and student learning", which requires leadership and motivational skills that inspire students to be successful (Rhoton & McLean, 2008, p. 45).

Furthermore, models of education should be considered as another tool for creating success in the classroom (Ornek, 2008). Science education models include the mental models, conceptual models, and mathematical models, and use of these models provides teachers with different tools for introducing topics or addressing different student needs in the classroom (Ornek, 2008). For example, mental models engage students on the level of creating images that must be designed to support the necessary elements, while conceptual models focus primarily on the concepts, and mathematical models are number related; all three of these concepts appeal to different student learning styles (Ornek, 2008; Fortuin, van Koppen, & Leemans, 2011; Kablan & Kaya, 2013). However, presenting these models as a combined resource to students invites students to consider the material in a different method, and promotes thought, but engagement in the materials could be most successful when encouraging students to create these models from the materials provided (Ornek, 2008).

In addition, using technology is another method for creating success in science and technology in the classroom (Delen & Bulut, 2011). Offering opportunities for students to explore the world of science through technological implementations provides the ability for

students to achieve goals in the completion of study and work, such as by viewing social media, studying current events, or even through exploration of technology as an aspect of the science itself (Delen & Bulut, 2011). Technology is considered an active learning tool, which requires students to actively seek information rather than to passively receive that information from teachers (Turkmen, 2006). However, a study with Turkish students suggested that the use of technology by the school did not have a direct influence on science achievement of students (Delen & Bulut, 2011). The results from this research suggest that the use of technology should be carefully weighed by each of the assignments teachers provide to students and teachers should seek out relevance that increases motivation and interest (Delen & Bulut, 2011).

In a recent case study aimed at investigating the student's motivation to learn chemistry, Salta and Koulougliotis (2012) established that many high school science teachers contend that one of their major instructional obligations is to promote students' interest towards learning, thereby increasing the student's intrinsic motivation to learn.

Another important aspect regarding teacher expectations in students' interest in science is the teacher's own interest in the subject. Demanet and Van Houtte (2012) conceptualized that teacher's own interest can have a significant effect on students' academic development, because the teacher is intrinsically motivated to teach his or her students about the subject that he or she finds interesting.

The authors hypothesized that teachers' expectations about the students' abilities can influence their later academic success, regardless of their actual ability, because teachers who have an internal, intrinsic interest in helping their students and expect more will give their students the time, attention and class designs to help them succeed (Demanet and Van Houtte, 2012).

On the other hand, low expectations for students on the part of the teacher are associated with students' feelings of futility and inadequate teacher support, which not only effect both motivation and therefore achievement, but can also lead to student misconduct (such as rule breaking, attention seeking behavior, etc.), which in turn can have a negative impact on the overall learning environment (Demanet and Van Houtte, 2012). This relationship between motivation, teacher motivation and misconduct was explored in multilevel analyses of data involving 2104 teachers and 11,844 students in 84 Flemish secondary schools between 2004 and 2005. The authors established that students attending schools with low teacher expectations report less teacher support, which is in turn linked to higher rates of student misconduct (Demanet and Van Houtte, 2012).

Increasing Student Motivation

Motivation acts as a force that regulates, directs, and enhances students' academic achievements, and must be considered when planning a lesson or designing a curriculum; because without motivation, very little learning can take place (Williams and Williams, 2011). Gherasim et al. (2012) held that motivated students enjoy learning science, are responsible for their learning, and believe in their learning abilities. In their study, Gherasim, Mairearn, and Butnaru (2012) investigated the role of motivation and the perceptions of classroom context as influencers of student achievement among high school students. A regression analysis indicated that intrinsic motivation, external motivation, and peer support were significant predictors of students' outcomes (Gherasim, et al., 2012).

In examining students' motivations to learn science, education researchers seek to determine why some students struggle, and the effect of factors such as the students' intensity of effort, beliefs, emotions, and feelings on learning outcomes (Gherasim, et al., 2012). Williams

and Williams (2011) suggested that student interest towards science is dependent on various factors including: individual and social factors, the hierarchy of needs, and the student's perceptions about their own well-being.

In terms of social factors, the overall motivation is dependent on issues like the possibility of finding a relevant job after school, future expectations, desire for further education, and priorities, among other factors (Sesen and Tarhan, 2010). Science teachers should strive to link the science concepts to the students' future lives by elaborating the importance of science literacy, explaining the available career opportunities in the scientific field, and inviting science professionals to mentor students (Williams and Williams, 2011).

Studies that involve comparing the effect of teacher influence versus peer influence on student learning outcomes in science indicate mixed findings. Some studies suggest that most high school learners depend on peer support while others suggest that teacher support is more crucial in influencing student outcomes (Salta and Koulougliotis, 2012). Some researchers have taken another view, and observe that peer and teacher supports complement each other in enhancing student achievement in science. In this paradigm, teachers tend to offer more support to students in a socially integrated setting. Conversely, peers tend to express more support to peers who receive more teacher support (Gherasim, et al., 2012).

The student's role in science education is crucial and goes beyond the conventional view in which the student is viewed as a knowledge recipient; thus, teachers should create an environment that facilitates student learning while schools should provide an environment to foster relationships among the players in science instruction (Sesen and Tarhan, 2010).

Recently, science educators have recognized the need to utilize innovative approaches to enhance student outcomes in science (Lou, Lin,Shih, and Tseng, 2012). Computer games and

multimedia technologies are particularly helpful due to their interactive nature. According to Holmes (2010), these technologies have become innovative in learning and teaching science because of their ability to capture the students' attention. In a study aimed at assessing how computer games influence students' science learning, attitudes, and interests about science, Holmes (2010) established that students' attitudes towards science improved as their interest increased. Further, the students' post-science assessment scores increased as their attitudes and pre-interests about a scientific interest increased (Holmes, 2010).

Given the increasing value of information technology in many aspects of life, science teachers should be able to utilize technology to enhance students' learning effectiveness in science (Lou, et al., 2012). To support this, Lin et al. (2012) conducted a study in Taiwan that involved 54 eighth-grade students and aimed to discover the effect of "multimedia teaching" on teaching chemistry for high school students. They found positive and satisfactory results; the students indicated that video presentations genuinely assisted them in understanding the experiment (Lou, et al., 2012).

Also, the ability to use hands-on activities, or activity-based learning, can increase motivation and interest in students (Hussain, Anwar, & Majoka, 2011). Research using a control and experimental group of 44 students each, experimented with activity-based learning and found that students with this method of education demonstrated significantly higher scores on testing following the learning (Hussain, Anwar, & Majoka, 2011). Additionally, hands-on activities with technology can improve upon science learning, by requiring that students actively engage in the learning process by searching for solutions or information (Hussain, Anwar, & Majoka, 2011; Isman, Yaratan, & Caner, 2007). Information technology is recognized as a

valuable resource for engaging students in actively gathering knowledge in a subject (Isman, Yaratan, & Caner, 2007).

In addition, building a relationship with the material can assist in creating the relationship and motivation necessary for students to engage in the learning and accomplish the goals of learning (Sládeka, Tomáš Miléřa, & Renáta Benárová, 2011). In chemistry, laboratory experiments have been found to increase interest and motivation in secondary school students (Wan Yunus & Mat Ali, 2012). Experiments involve the aspects of problem-solving and scientific investigation, creating value to students (Wan Yunus & Mat Ali, 2012). This can also be demonstrated through inquiry learning and teaching, which focuses on science investigation, where students are able to use the concepts to solve problems and create an understanding of the materials through engagement of applying them to a specific situation or situations (Moeed, 2013). Scientific investigation promotes the use of information gathering skills. Furthermore, the combination of laboratory and computer assisted learning or information tools, has been found to promote application, interactive learning through peer-collaboration, and skills in investigative learning (Saka, 2012). These types of skills can be beneficial to students in the future, as continued changes in technology and the application of technology are a direct influence on daily life (Saka, 2012).

Moreover, cooperative learning may be another approach to increasing student motivation in sciences (Köse, Sahin, Ergün, & Gezer, 2010). For example, students in small groups can dissect the assignment, share meaning of the contents, and develop problem-solving in team settings (Köse, et al., 2010). Past research suggests that cooperative learning can create opportunities for motivation through engaging the students in a new and unique way that invites the conversation of science and the opportunity to share ideas with peers and can be more

effective than direct instruction (Köse, et al., 2010). Science fairs can be used to create cooperative learning environments for students, as a result of the intrinsic rewards of this type of application of science learning. However, some research suggests that not all students have found science fair experiences to be appealing or completely successful (Korkmaz, 2012). In this way, the design of the science fair could be very important for the success of the science fair to achieve the goal of increased involvement, engagement, and motivation (Korkmaz, 2012). This could be accomplished by careful planning, addressing potential problems early, and designing the fair to support multiple types of admissions, such as those from cooperative learning teams (Korkmaz, 2012).

The use of cooperative learning can be as a reward or as a learning tool. Abootorabi (2011) discovered that students were able to grasp concepts easier and more completely when working in teams that were required to ensure that all members of the team learned and understood the material in the classroom. Strong student groupings can also allow students to benefit from the skills of others, while being valuable components of the team with the knowledge that is part of their individual strengths (Saka, 2004). Furthermore, cooperative learning does not reduce the ability to analyze the strengths and knowledge of the individual student, and can be utilized to build self-confidence in students (Saka, 2004).

Motivation in regards to high school students and physics classes was not found to be directly related to the factors of money, providing institution, cost of education, place of education, or family residence, which suggests that other aspects are contributing to attitudes towards science and math (Pehlivan & Koseoglu, 2011). However, research suggests that opportunities, such as after-school programs, have an influence on interest in science and can promote the awareness of the field, creating motivation (Lundh, House, Means, & Harris, 2013).

After-school programs have many benefits to students, including providing the students with extra assistance in work, someplace to learn new things, and opportunities for students to engage in activities that are both safe and healthy (Lundh, et al., 2013).

Lastly, gender inequality in the sciences has been a topic in many sources of literature and research over the decades, and this demonstrates differing attitudes towards science that can directly influence the success of students in science classrooms (Korkmaz, 2012). Stereotyping of science professions has a negative influence on the ability of students to take an interest in the subject as a potential career in adulthood (Korkmaz, 2012). Images that are shared between students often include the idea that scientists are male, lack imagination, are impersonal, and are robotic or superficial (Christidou, 2011). Also, in research, gender has been correlated with negative views in science, specifically in identifying the field as male dominated and "without moral or social inhibitions" (Christidou, 2011, p. 144). Views of science have resulted in smaller numbers of female science students, particularly in secondary education and as a source of careers (Quinn & Lyons, 2011). Therefore, educators should work to increase awareness of job opportunities, to decrease support for gender preconceptions, and to increase knowledge of individuals working in the field of science in order to achieve the balance between genders (Quinn & Lyons, 2011).

High School Education in Saudi Arabia

The education system in Saudi Arabia falls under the administration of the Ministry of Education (World Data on Education Saudi Arabia, 2010). Also, the education system segregates boys and girls in schools, so, each of them have independent schools (Sedgwick, 2001). However, Both of them are studying the same curriculum and taking the same annual exams (Sedgwick, 2001).

"The educational curriculums at Saudi schools are diverse. They include a variety of subjects such as math, science, literature, history, Arabic and Islam. The Ministry of Education sets overall standards and oversees special education for the handicapped" (Royal Embassy of Saudi Arabia, n.d.,).

"Students can choose whether to attend a high school with programs in commerce, the arts and sciences, or a vocational school. In high school, students take comprehensive exams twice a year under the supervision of the Ministry of Education" (Royal Embassy of Saudi Arabia, n.d,). High school education in Saudi Arabia is considered as the final stage of general education (World Data on Education Saudi Arabia, 2010). It consists of three stages (World Data on Education Saudi Arabia, 2010). In the first year, students have to study the entire common curriculum; after that, they have to choose their curriculum - whether they want to study science curriculum or literary curriculum (Sedgwick, 2001). In other words, in the second and the third year students are divided into scientific and literary sections according to their interests. Thus, students have to pass the general examinations in order to get the general high school certificate (Sedgwick, 2001).

Methodology

In this study, a quantitative approach was used to identify the attitude of female students towards science and the source of their interest or lack of interest towards the subject. A survey was conducted to collect data from the participants.

A. Participants and Setting

The sample for this research study consisted of 148 female high school students, aged 16 to 18. Stratified sampling was appropriate for the nature of the study because it aimed to include female survey respondents. The objective of selecting this population for the sample was to find

out the attitude of female students towards science in high school and determine the causes that affect their interest in the study of science. The researcher made sure to get students' points of view from two sides: those interested or not interested in studying science.

This research took place in Najran, a city in South Saudi Arabia. The school has general education curricula. The school had around 300 female students and 45 female teachers. The average class size was 25 students. The classification of prospective participants was 26% first-year students, 52% second-year students, and 22% third-year students.

In that school, most of the students were Saudis, while there were a few from different nations, such as Egypt, Syria, and Jordan. It was almost a culturally homogeneous sample because participants were from Saudi Arabia and neighboring Arab countries and they were living and studying in the same cultural environment.

In addition, the study was conducted in the middle of the school year to enable the participants to establish their attitude and interest towards science. By that time, their interest or lack of interest towards the subject was likely already stable. This paved the way for more reliable results to be obtained from the participants concerning the major variable in the study.

B. Instrument

The research instrument that was utilized was the "ROSE (The Relevance of Science Education), which is a questionnaire mostly consisting of closed questions with four-point Likert scales" (Schreiner & Sjøberg, 2004, p. 35). However, this study used five-point Likert-type scales instead of four-point Likert scales in order to produce more depth and accuracy during the data analysis. The goal of the ROSE questionnaire is to figure out what students think about science in school or even in their daily lives (Schreiner & Sjøberg, 2004, p. 21).

The questions in the ROSE questionnaire were based on student experiences and interests

in science at school and outside school (Schreiner & Sjøberg, 2004). The ROSE has many questions, but the researcher used only 26 questions that were really matched with the topic.

Student participants were asked to complete a survey. It was composed of 25 questions, which were intended to determine the participants' level of interest or lack of interest in science. The responses were given corresponding numerical values from 1 to 5, ranging from strongly disagree to strongly agree. Strongly disagree was given a numerical value of 1 and strongly agree was given a numerical value of 5.

The preparation of the instrument needed careful attention. The survey's original text was in English. However, to cater to those participants who did not speak English, the set of surveys was translated into Arabic. This was to ensure that language barriers did not affect the outcome of this study.

C. Data Collection and Procedures

In order to collect the data, the researcher needed to obtain approval from the director of the school. After receiving this approval, the researcher visited the school at different times on different occasions. The researcher asked students in their classrooms if they wanted to participate. The surveys were printed out and given to them in paper format. The survey asked for demographic information and presented closed-ended (Likert-scale) questions.

The nature and purpose of the survey were explained to the participants before they answered it. They were informed that the data being collected was for research only and would not affect their grades. Then, the participants were given the survey during breaks to avoid interference with the students' actual engagement in their lessons. The participants were able to take the forms home to complete the survey if needed.

The survey forms were collected at a later date to provide the participants with ample time

to read and understand the content. However, the survey forms were collected no later than one week after being given to the participants. The data obtained from the participants was gathered and collated for interpretation.

D. Data Analysis

After the data was gathered, each participant's responses were analyzed and given a point value based on a scale from 1 to 5, where 5 shows a strong interest towards that question and 1 shows no interest or negative interest. The obtained data was translated into graphs and tables in order to provide a comprehensive and easy-to-understand presentation of the data for in-depth analysis.

Furthermore, frequency distribution and descriptive statistics were used to interpret the data. The frequency distribution was helpful in determining the number of students who showed interest or lack of interest towards science. The mean and standard deviations could speak for the interest or lack of interest of the participants when taken as a group. From the data provided by the frequency distribution, mean deviation, and standard deviation, analyses could be made. It should be noted that the mean and standard deviations were obtained from the numerical values of the five-point Likert scale. The results of the data analysis determined the results of the study.

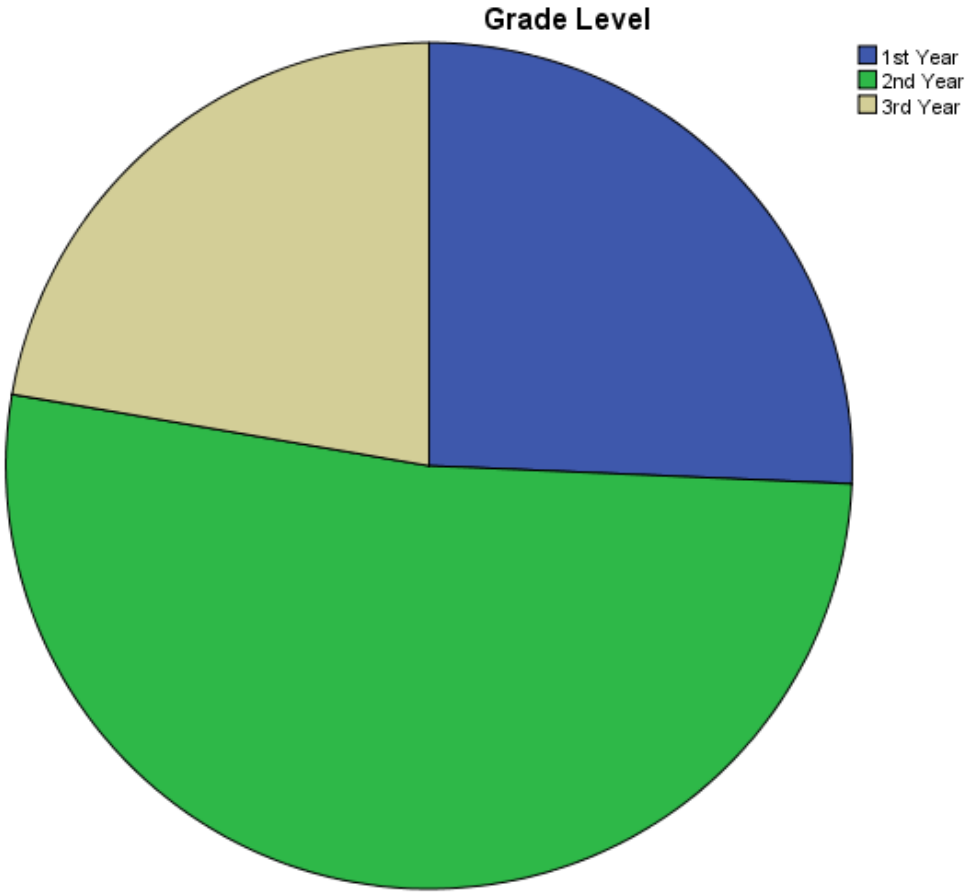
Findings

The data was obtained via a survey and the analysis was performed using SPSS software. This section presents the data that will be used to answer the research questions.

Describing the Sample

Grade Level. Of 148 participants in this study, 38 (26%) were the first grade students, 77 (52%) were the second grade students, and 33 (22%) were the third grade students (See Figure 1).

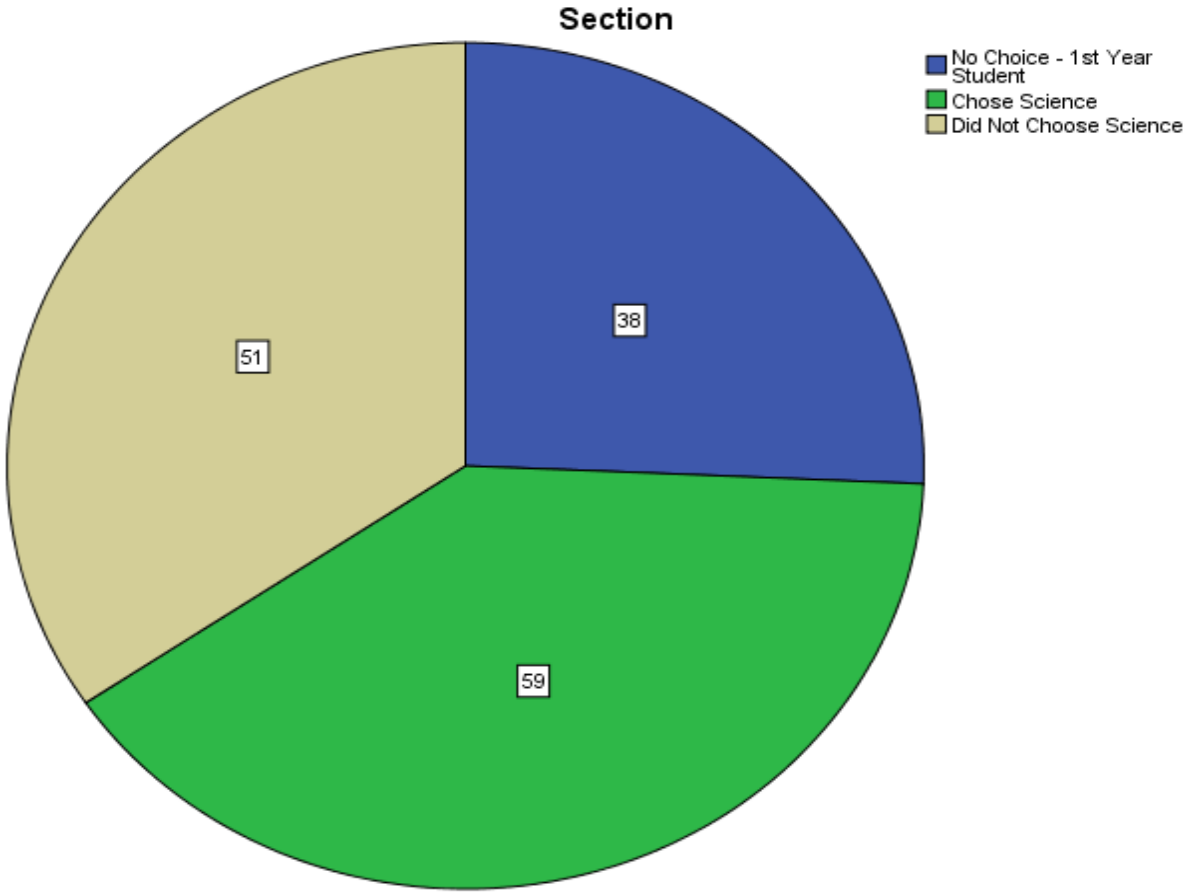
Figure 1. Number of Participants According to Grade Level



Section. The majority of the participants in this study had chosen to study a scientific curriculum. Of the 148 participating students, only 38 (26%) did not have a choice of section,

while 59 (40%) chose to study a scientific curriculum and 51 (34%) chose to study a literary curriculum instead (See Figure 2).

Figure 2. Number of Participants According to the Section



Findings Regarding Science Classes

All of the participating students were asked about their science classes. Issues related to the science classes were measured by questions 1 to 14 (see Appendix B for further details). This section explains the students' responses to some selected questions, namely questions 2, 4, 9, and 10.

School science is interesting

Table 1.1. Mean and Standard Deviation Report

Grade Level			S2. School science is interesting
1st Year	No Choice - 1st Year Student	Mean	3.43
		N	37
		Std. Deviation	1.168
	Total	Mean	3.43
		N	37
		Std. Deviation	1.168

The students' ratings vary, as indicated by the standard deviation, which is 1.168. The standard deviation of this magnitude suggests a scattered distribution of scores. Thus, a standard deviation of 1.168 means that the respondents' ratings are widely distributed (Table 1.1). The mean of the responses from the first year students is 3.43.

Figure 3.1. S2. School science is interesting – First year students

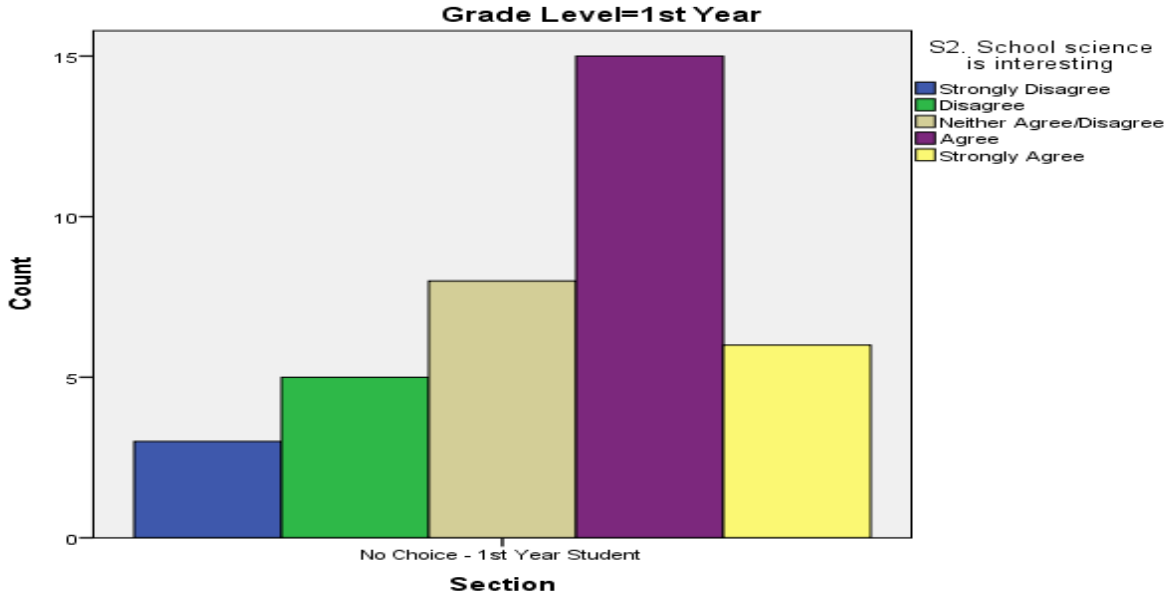


Figure 3.1 shows that more than 50% of the first year respondents either agreed or strongly agreed with the statement that school science is interesting. In terms of numbers, 15 out of the 38 first year students agreed that school science is interesting, while 6 students strongly

agreed with the statement. These numbers translate to a likelihood that most (21 out of 38) of the first year students find science interesting. The remaining respondents are fairly evenly distributed between the other possible responses. In terms of whether science is an interesting subject, the responses of the first year students exhibited a high standard deviation, meaning that there is a large variation in the data set and so the results are statistically significant (See Table 1.1).

Table 1.2. Mean and Standard Deviation Report

Grade Level			S2. School science is interesting
2nd Year	Chose Science	Mean	3.63
		N	49
		Std. Deviation	.929
	Did Not Choose Science	Mean	2.36
		N	28
		Std. Deviation	.989
	Total	Mean	3.17
		N	77
		Std. Deviation	1.129

The mean of the second year students who chose to continue high school science is 3.63. This mean expresses a strong agreement between the students who chose to continue studying science and those who agreed with the statement that school science is interesting. The obtained mean is the highest of all the means related to respondents who chose science, regardless of the level of classification.

The standard deviation of the students who chose science is 0.929. A standard deviation of this value indicates that the scores are widely distributed among the different ratings. However, the numerical data obtained suggests statistical significance in terms of the students' view of science as an interesting subject to study in school (See Table 1.1).

Overall, the mean rating in Table 1.2 is 3.17 and the standard deviation is 1.129. This indicates that the opinions of the second year students regarding science as an interesting subject tend towards neutral. The ratings of the students vary highly as well.

The standard deviation of the students who chose science is > 1, meaning that there is a high variation in the group and so the results are statistically significant. For those who did not choose science, the standard deviation also shows statistical significance as well as a wide variation relative to the mean (See Table 1.1).

Figure 3.2. S2. School science is interesting – Second year students

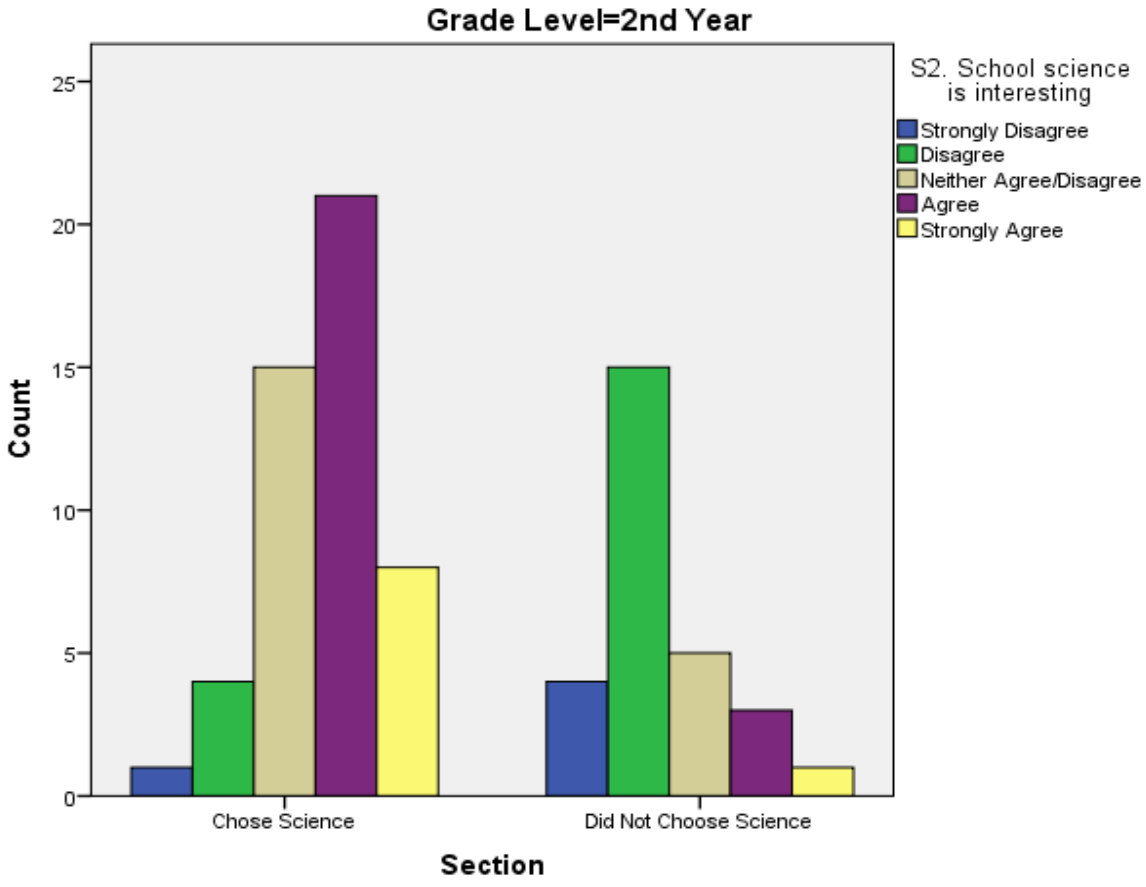


Figure 3.2 highlights how, among the second year students, the majority (n=21) of those who chose to pursue science were in agreement that science is interesting. This was followed by

those (n=15) who were neutral about whether or not science is an interesting subject. Next came the (n=8) second year students who strongly agreed that it is an interesting subject, while less than a fifth (n=4) disagreed that science is an interesting subject. Only a small minority (n=1) of the students strongly disagreed that science in an interesting subject.

On the other hand, of the students who did not choose science, over half (n=15) disagreed that science is an interesting subject, while about a third of that number (n=5) remained neutral on the matter. Less than a fifth (n=4) strongly disagreed that science is an interesting subject, followed by a slightly smaller number (n=3) who agree that science is an interesting subject. Only a very small number (n=1) of these students strongly agreed that science is an interesting subject (See Figure 3.2).

Table 1.3. Mean and Standard Deviation Report

Grade Level			S2. School science is interesting
3rd Year	Chose Science	Mean	4.50
		N	10
		Std. Deviation	.527
	Did Not Choose Science	Mean	2.52
		N	23
		Std. Deviation	.898
	Total	Mean	3.12
		N	33
		Std. Deviation	1.219

Considering the responses from those students who chose science, the mean is 4.50, which suggests that they consider science to be more interesting than most other subjects. A mean of this magnitude indicates that the ratings are concentrated or clustered close to "Strongly Agree". This concentration of ratings is confirmed by the standard deviation of 0.527, which suggests that there is only low variation in terms of the distribution of ratings.

The responses from the students who did not choose science exhibit a standard deviation of 0.898, showing variability with respect to both the mean and statistical significance of the results.

The overall mean also indicates that the scores are not equally distributed to the different rating options, as evidenced by Figure 3.3 below.

Figure 3.3. S2. School science is interesting – Third year students

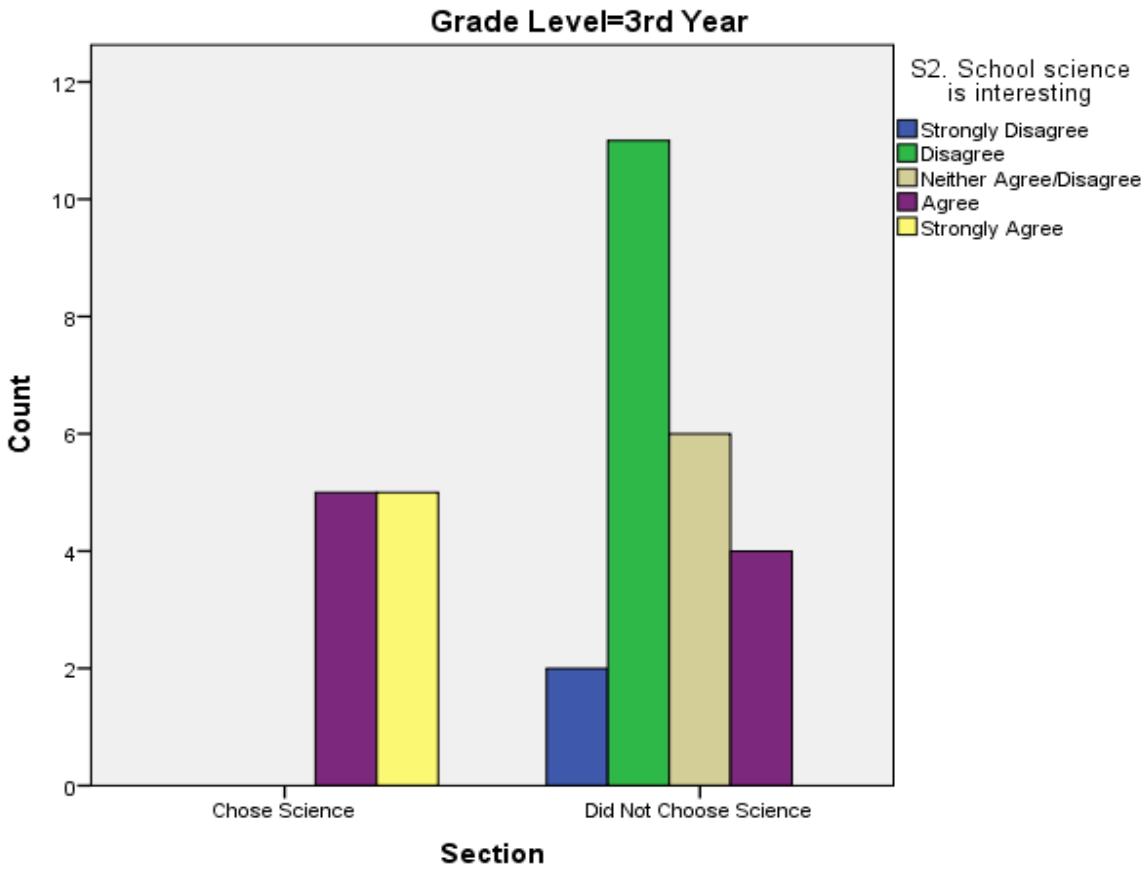


Figure 3.3 above confirms this unequal distribution as only the ratings "Agree" and "Strongly Agree" are represented among the responses of the third year students who chose science. Half of these students (n=5) agreed that school science is an interesting subject, while the same number strongly agreed that school science is an interesting subject. Conversely, among those who did not choose science, a large number of students (n=11) disagreed that school science is interesting, followed by those (n=6) who were neutral about whether or not school science is interesting. However, four members of this group agreed that school science is interesting, while only a small number (n=2) strongly disagreed that school science is interesting.

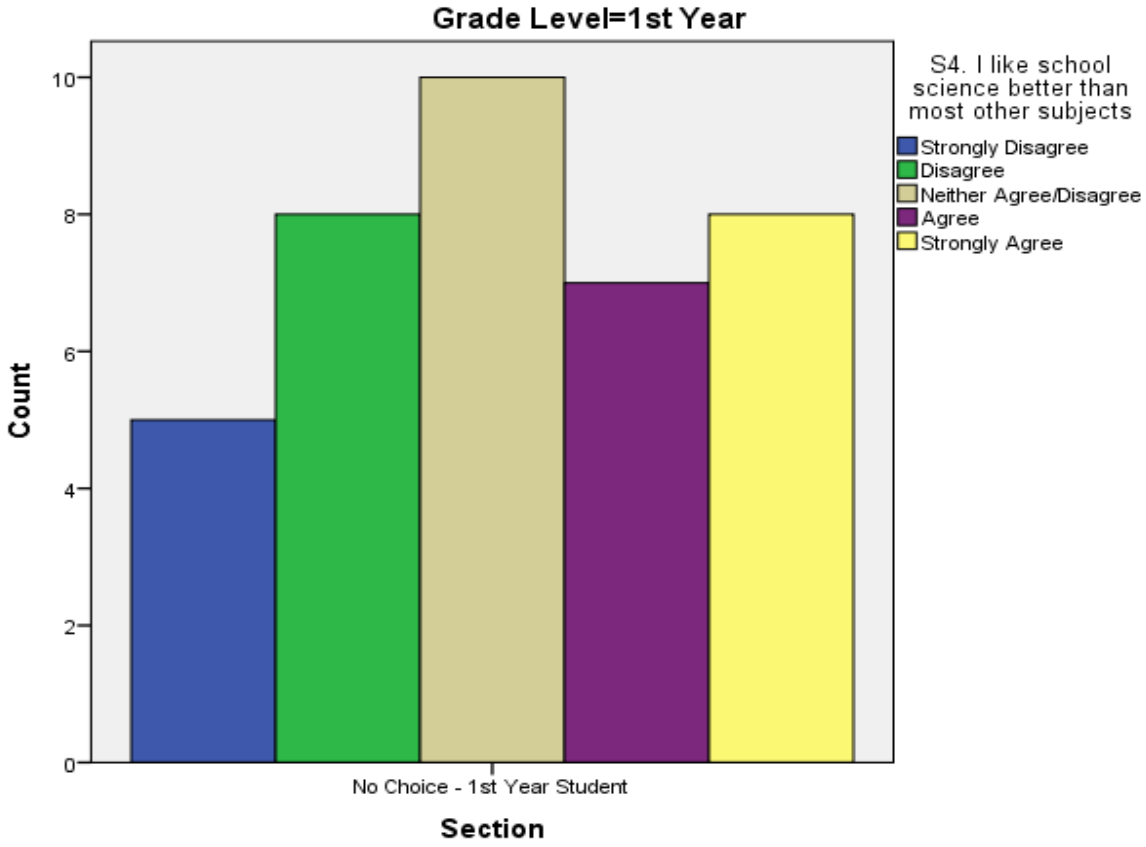
I like school science better than most other subjects

Table 2.1. Mean and Standard Deviation Report

Grade Level			S4. I like school science better than most other subjects
1st Year	No Choice - 1st Year Student	Mean	3.13
		N	38
		Std. Deviation	1.339
	Total	Mean	3.13
		N	38
		Std. Deviation	1.339

The results in Table 2.1 are statistically significant at 1.333 and show a high variation with respect to the mean. The standard deviation for this group is 1.126, which proposes that the opinions of the students in this group with regard to question 4 are widely distributed.

Figure 4.1. S4. I like school science better than most other subjects – First year students



Among the first year students, the highest grouping (26%) were neutral about whether they like school science more than the other subjects, while only slightly less (21%) disagreed that they like school science more than the other subjects, which is a similar percentage to that of those who strongly agreed with the statement. Only some seven students (19%) agreed that they like school science better than the other subjects, while some five students (13%) strongly disagreed.

Table 2.2. Mean and Standard Deviation Report

Grade Level			S4. I like school science better than most other subjects
2nd Year	Chose Science	Mean	3.73
		N	49
		Std. Deviation	1.186
	Did Not Choose Science	Mean	2.11
		N	28
		Std. Deviation	1.197
	Total	Mean	3.14
		N	77
		Std. Deviation	1.421

Among the second year students, the number of those who chose to continue with high school science is far greater than the number who did not choose to continue studying it. Figure 4.2 below shows the discrepancy in terms of the number of students. The overall mean for this group is 3.73, which indicates almost complete agreement with the statement. This means that the students in this group generally favor science over any other subjects. The standard deviation is 1.186, which also indicates a high variation in the ratings of the students.

For those who chose science, a mean of 3.73 was obtained. This mean rating signifies that the students collectively agree that science is better than any other subjects taught in school. However, despite the observed inclination towards complete agreement, the scores are still widespread, which means that there are still students who did not agree and indeed strongly disagreed with the statement. This disagreement resulted in a standard deviation that is > 1.0.

Figure 4.2. S4. I like school science better than most other subjects – Second year students

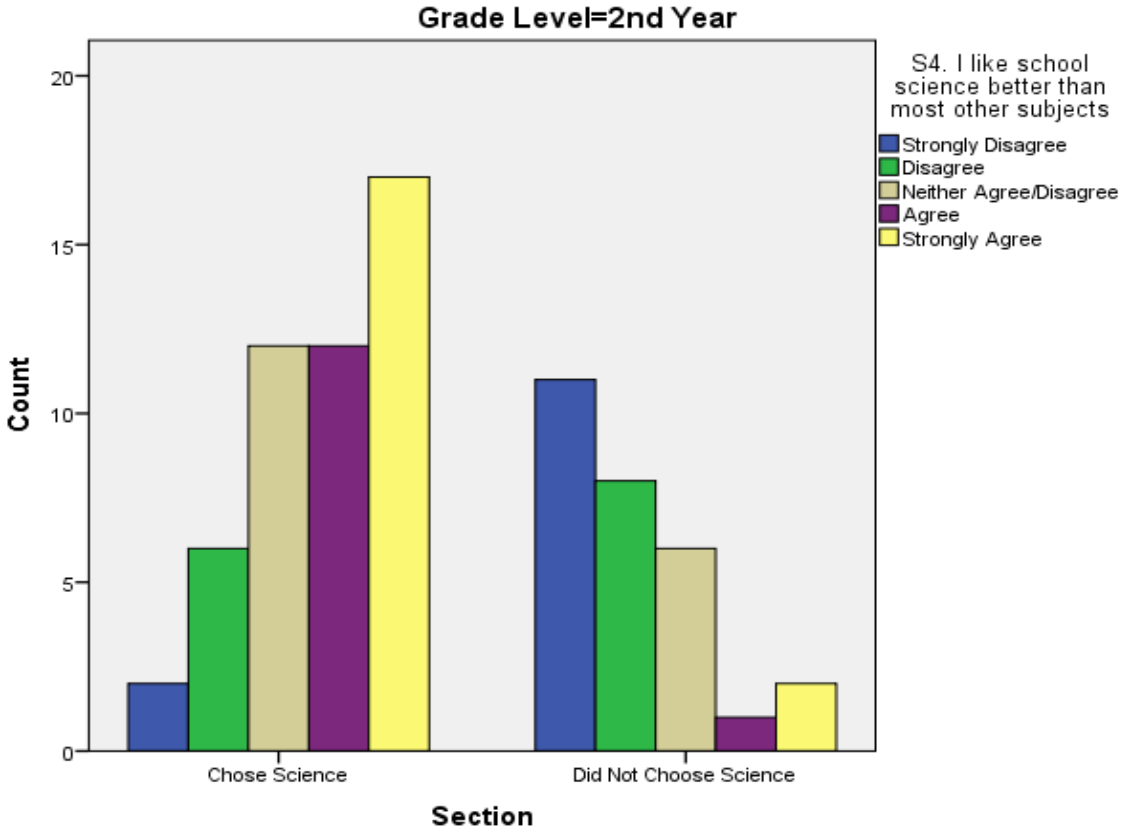


Figure 4.2 illustrates how most of the second year students (35%) who chose science strongly agreed that school science is better than other subjects, and that some 12 students (24%) agreed with the statement. The same numbers of students were neutral about whether they like science more than the other subjects. Some six students (12%) disagreed that they like school science better than the other subjects, while only two (4%) strongly disagreed that school science is better than the other subjects.

In contrast, of the students who did not choose science, more than a third (39%) strongly disagreed that they like science more than any other subjects, followed by eight students (29%) who disagreed that school science is their favorite subject. Just over a fifth (21%) were neutral regarding whether school science is their favorite subject, while two students (7%) strongly

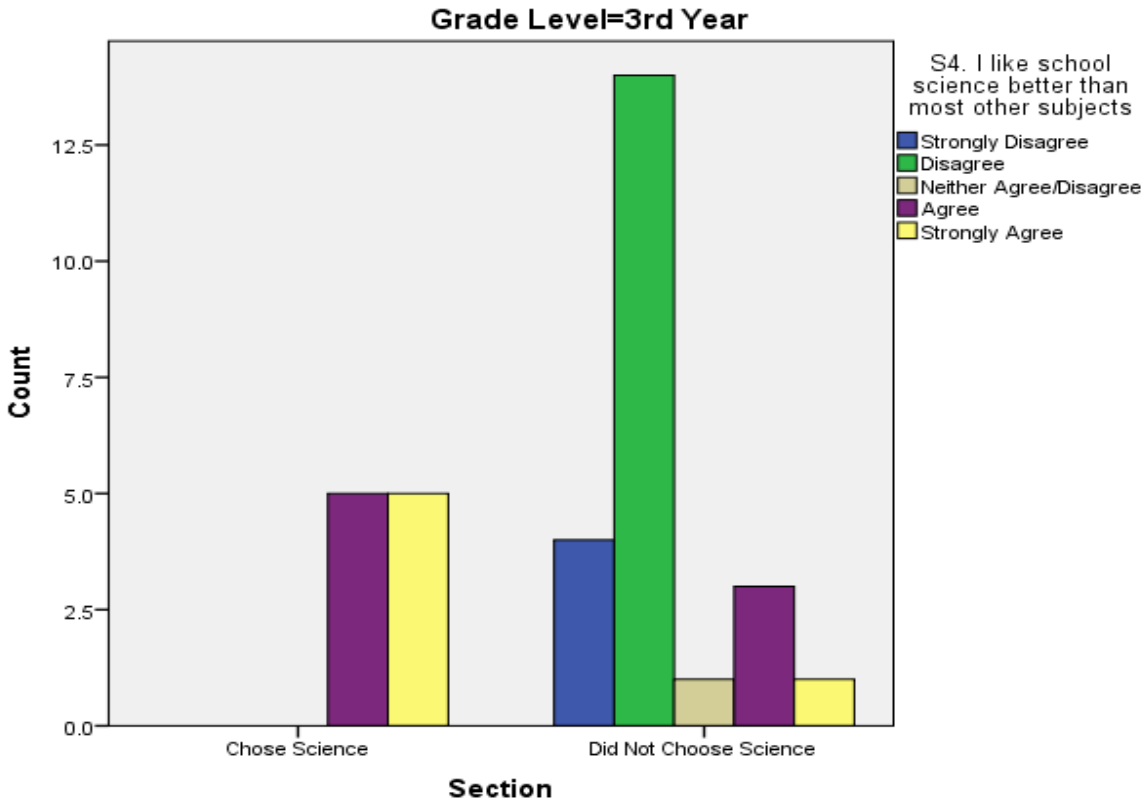
agreed that science is their favorite subject. A very small number (4%) agreed that school science is their favorite subject.

Table 2.3. Mean and Standard Deviation Report

Grade Level			S4. I like school science better than most other subjects
3rd Year	Chose Science	Mean	4.50
		N	10
		Std. Deviation	.527
	Did Not Choose Science	Mean	2.26
		N	23
		Std. Deviation	1.054
	Total	Mean	2.94
		N	33
		Std. Deviation	1.391

The responses of the third year students are statistically significant, with a standard deviation > 1, showing a wide variation with respect to the mean. The standard deviation for the third year students' responses is 1.391, showing statistical significance and variability with respect to the mean.

Figure 4.3. S4. I like school science better than most other subjects – Third year students



Of the third year students who chose science, half (n=5) agreed that science is their favorite subject, with the same number strongly agreeing that their favorite subject is school science.

Among the third year students who did not choose science, the majority (61%) disagreed that their favorite subject at school is science, followed by almost a fifth (18%) who strongly disagreed that science is their favorite subject at school. Considerably fewer (13%) students agreed with the statement. Only a very small number (4%) of students were neutral about whether they feel science is their favorite school subject, with the same number strongly agreeing that school science was their favorite subject.

School science has increased my appreciation of nature

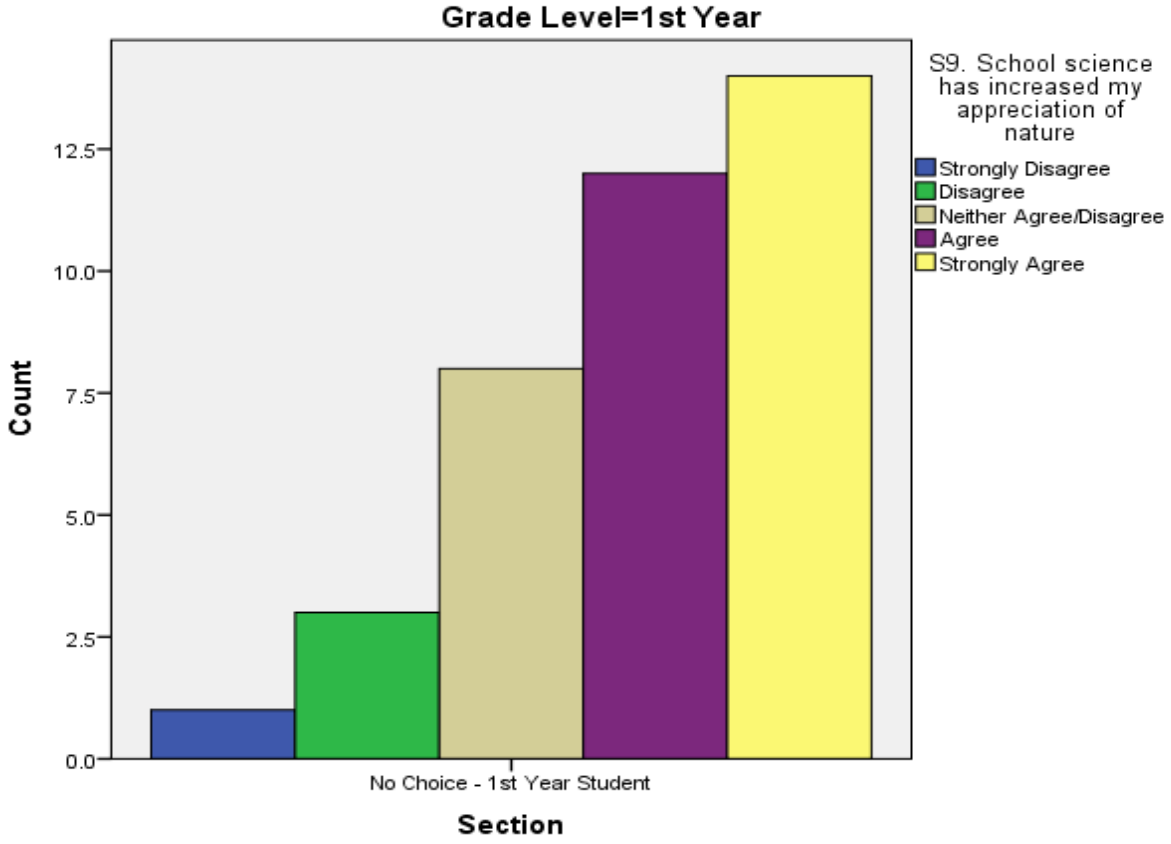
Table 3.1. Mean and Standard Deviation Report

Grade Level			S9. School science has increased my appreciation of nature
1st Year	No Choice - 1st Year Student	Mean	3.92
		N	38
		Std. Deviation	1.075
	Total	Mean	3.92
		N	38
		Std. Deviation	1.075

The group registered a mean rating of 3.92, which reflects the group's agreement about the contribution of science in increasing their appreciation of nature.

The standard deviation is > 1, showing variability from the mean and indicating that the responses are statistically significant.

Figure 5.1. S9. School science has increased my appreciation of nature – First year students



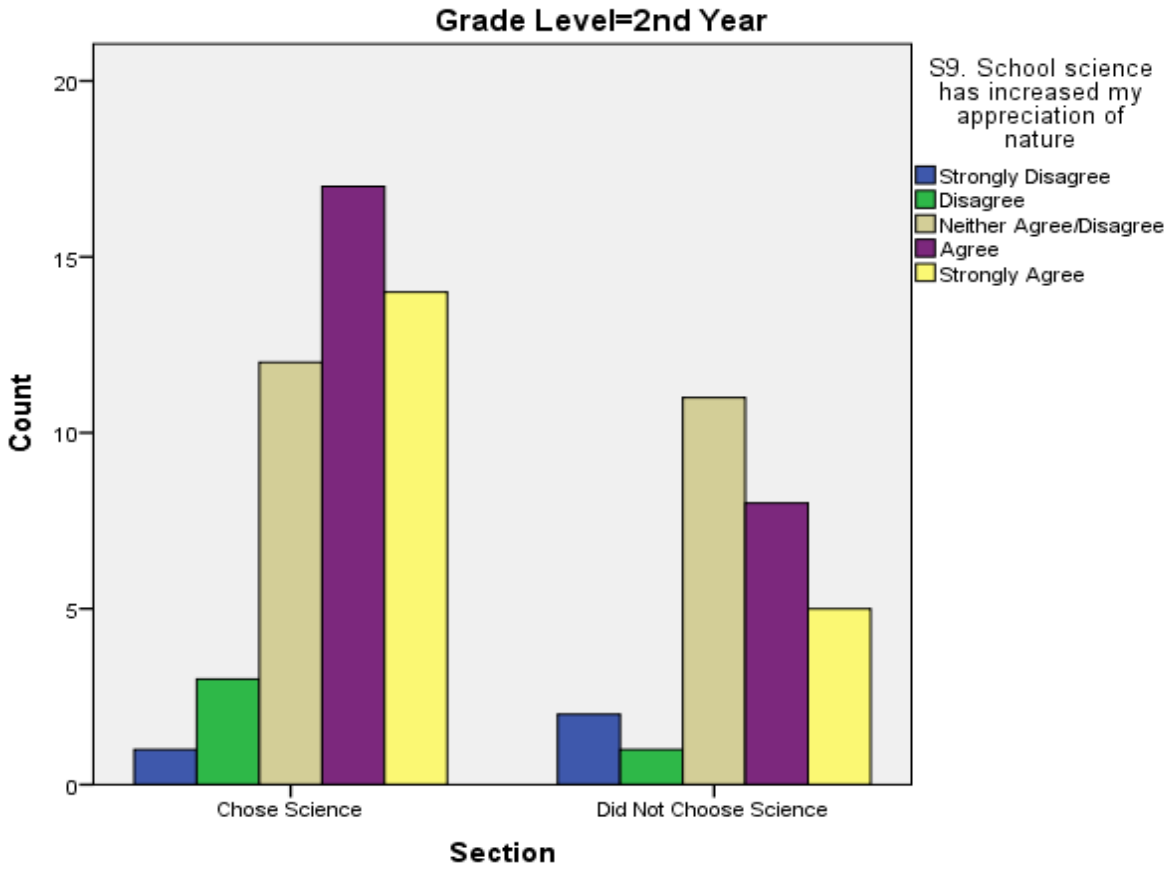
The highest grouping of first year students (37%) strongly agreed that school science has increased their appreciation of nature, followed by nearly a third (31%) who agreed with the same statement. Almost a fifth (21%) were neutral about whether school science has increased their appreciation of nature, while less than a tenth (8%) disagreed that school science has increased their appreciation of nature and only a very small number (3%) strongly disagreed with that statement.

Table 3.2. Mean and Stander Deviation Report

Grade Level			S9. School science has increased my appreciation of nature
2nd Year	Chose Science	Mean	3.85
		N	47
		Std. Deviation	1.000
	Did Not Choose Science	Mean	3.48
		N	27
		Std. Deviation	1.087
	Total	Mean	3.72
		N	74
		Std. Deviation	1.041

The standard deviation for this group is > 1 which shows variability and statistical significance.

Figure 5.2. S9. School science has increased my appreciation of nature – Second year students



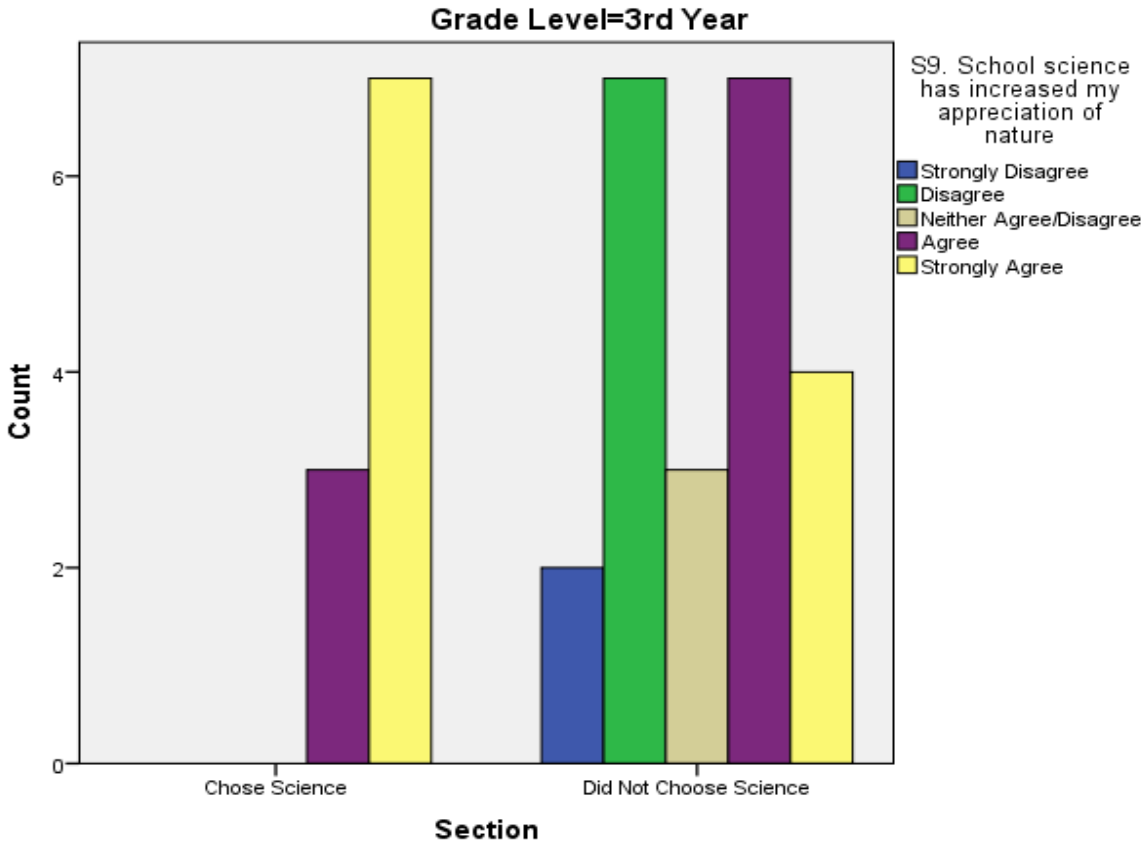
For the second year students who chose science, the highest concentration of participants (36%) agreed that school science has increased their appreciation of nature. Nearly a third (30%) strongly agreed, just over a quarter (26%) were neutral, less than a tenth (6%) disagreed and only a very small number (2%) strongly disagreed.

Of the students who did not choose science, when asked whether school science had increased their appreciation of nature, the highest percentage (41%) were neutral on the matter, nearly a third (30%) agreed, nearly a fifth (18%) strongly agreed, and less than a tenth (7%) strongly disagreed.

Table 3.3. Mean and Stander Deviation Report

Grade Level			S9. School science has increased my appreciation of nature
3rd Year	Chose Science	Mean	4.70
		N	10
		Std. Deviation	.483
	Did Not Choose Science	Mean	3.17
		N	23
		Std. Deviation	1.302
	Total	Mean	3.64
		N	33
		Std. Deviation	1.319

Figure 5.2. S9. School science has increased my appreciation of nature – Third year students



Among the third year students who choose science, when asked whether school science has increased their appreciation of nature, the majority (70%) strongly agreed while the rest

(30%) agreed. For the third year students who did not choose science, almost a third (31%) agreed that school science had increased their appreciation of nature, with a similar number disagreeing. Nearly a fifth of students (17%) strongly agreed, with just over a tenth (13%) being neutral and less than a tenth (9%) strongly disagreeing.

School science has shown me the importance of science for our way of living

Table 4.1. Mean and Standard Deviation Report

Grade Level			S10. School science has shown me the importance of science for our way of living
1st Year	No Choice - 1st Year Student	Mean	3.62
		N	37
		Std. Deviation	1.210
	Total	Mean	3.62
		N	37
		Std. Deviation	1.210

The overall mean for the first year students is 3.68 for this question. This group response has a standard deviation of 1.2, showing statistical significance as well as variability from the mean.

Figure 6.1. S10. School science has shown me the importance of science for our way of living – First year students

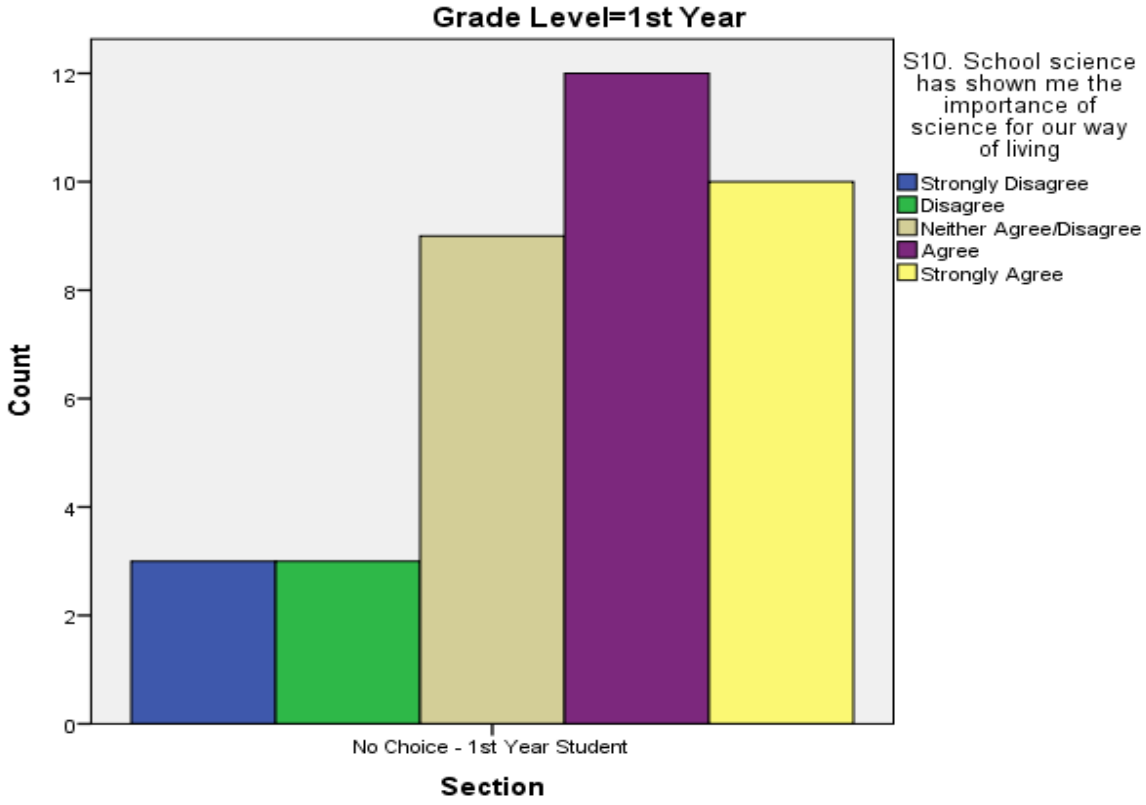


Figure 6.1 indicates that this group of students generally agreed with the statement about the importance of science to their way of living. From the figure, it can be concluded that the highest number of students (44%) agreed with the statement, while ten students (27%) strongly agreed and nine (24%) were neutral. Only three students (8%) disagreed, with the same number strongly disagreeing.

Table 4.2. Mean and Standard Deviation Report

Grade Level			S10. School science has shown me the importance of science for our way of living
2nd Year	Chose Science	Mean	3.62
		N	37
		Std. Deviation	1.210
	Did Not Choose Science	Mean	3.62
		N	37
		Std. Deviation	1.210
	Total	Mean	3.67
		N	76
		Std. Deviation	1.051

The group's mean is 3.67, suggesting a general agreement with the statement. The group's overall standard deviation is 1.051, which suggests greater variability.

Figure 6.2. S10. School science has shown me the importance of science for our way of living – Second year students

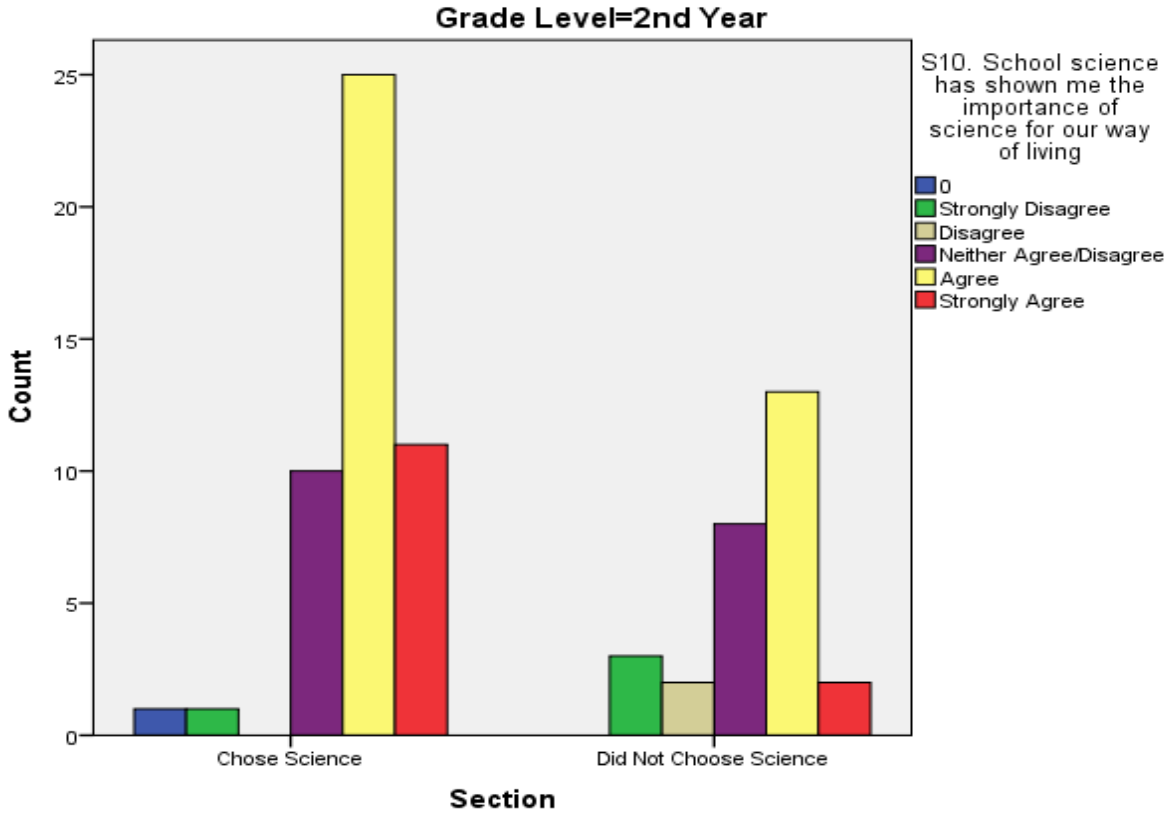


Figure 6.2 indicates that the majority (53%) of the second year students who chose science agreed that school science has shown them the importance of science to their way of living. Some 11 students (24%) strongly agreed, while a slightly smaller number (21%) were neutral. Only a very small number (n=1) (2%) strongly disagreed.

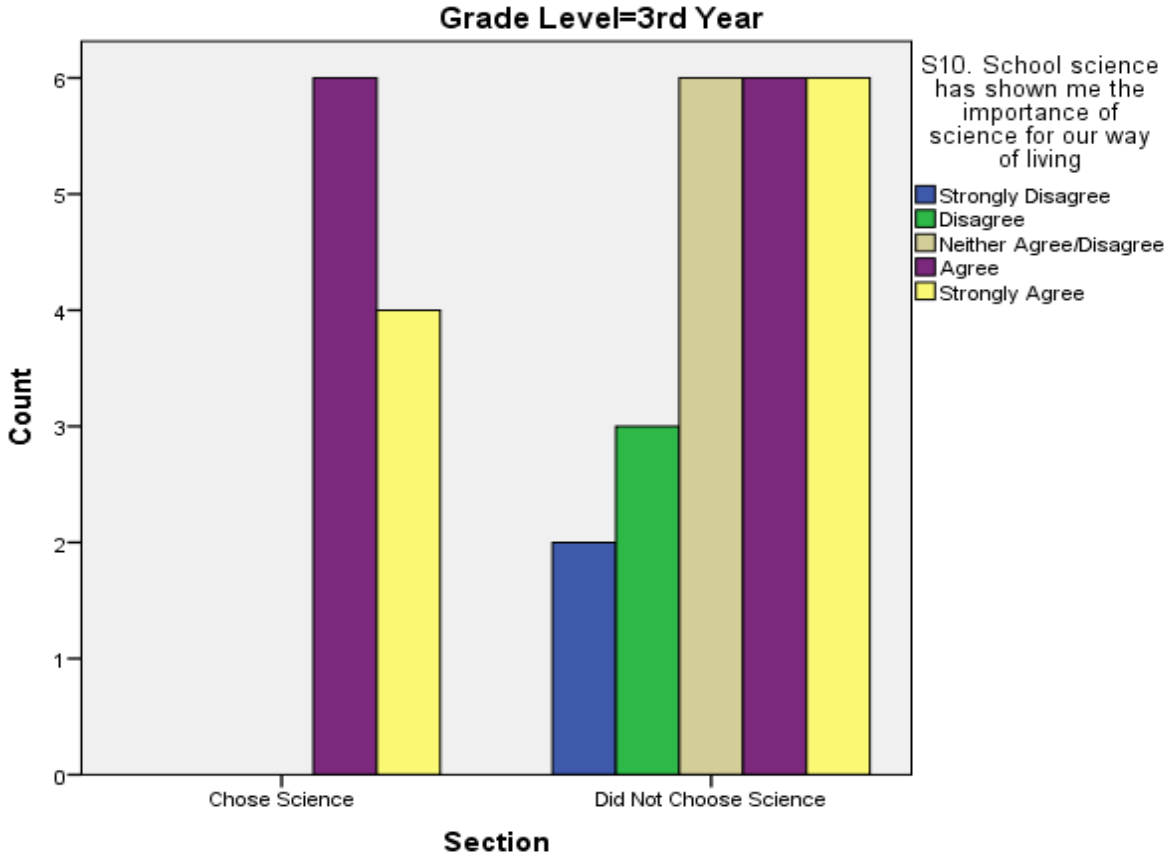
However, of those who did not choose science, only a far lower number (46%) agreed that school science had shown them the importance of science to their way of living. In addition, some eight (29%) students were neutral, while a very small number (n=2) (7%) strongly disagreed and the same number strongly agreed.

Table 4.3. Mean and Standard Deviation Report

Grade Level			S10. School science has shown me the importance of science for our way of living
3rd Year	Chose Science	Mean	4.40
		N	10
		Std. Deviation	.516
	Did Not Choose Science	Mean	3.48
		N	23
		Std. Deviation	1.275
	Total	Mean	3.76
		N	33
		Std. Deviation	1.173

The overall mean for third year students is 3.76, which states that nearly all students have agreement to the statement on the significance of science in daily life. Also, the standard deviation is 1.114 showing variability with respect to the mean and that the responses are statistically significant.

Figure 6.3. S10. School science has shown me the importance of science for our way of living – Third year students



As shown in Figure 6.3, of those students who chose science, six (60%) agreed that school science has shown them the importance of science to their way of life and four (40%) strongly agreed. Of those students that did not choose science, the same number (26%) agreed, strongly agreed or were neutral about the statement. Only three students (13%) disagreed with the statement, while two (9%) strongly disagreed.

Findings Regarding Science and Technology

All of the participating students were also asked their opinions about science and technology. Questions concerning science and technology were measured by questions 15 to 25 (see Appendix). This sections describes the participants' responses to selected questions, namely

All of the participating students were also asked their opinions about science and technology. Questions concerning science and technology were measured by questions 15 to 25 (see Appendix B). This section describes the participants' responses to selected questions, namely questions 14 and 17.

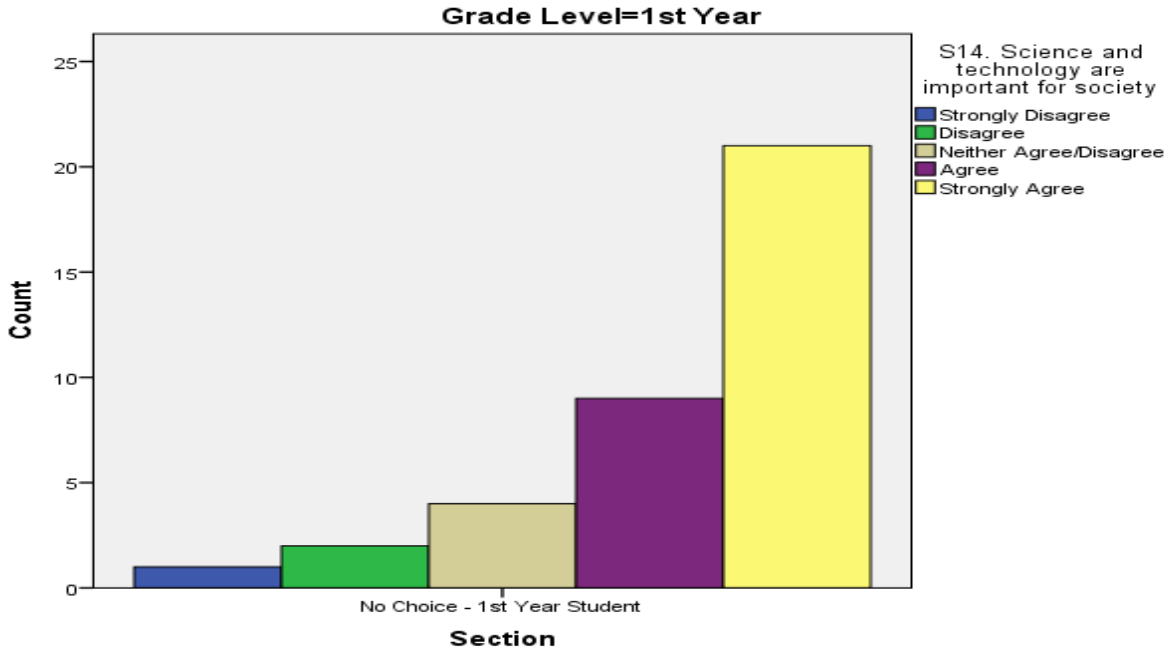
Science and technology are important for society

Table 5.1. Mean and Standard Deviation Report

Grade Level			S14. Science and technology are important for society
1st Year	No Choice - 1st Year Student	Mean	4.27
		N	37
		Std. Deviation	1.045
	Total	Mean	4.27
		N	37
		Std. Deviation	1.045

The overall mean for the first year students is 4.36, which indicates a high level of agreement about the importance of science and technology in society. The participants' responses have a standard deviation > 1, which indicates variability.

Figure 7.1. S14. Science and technology are important for society – First year students



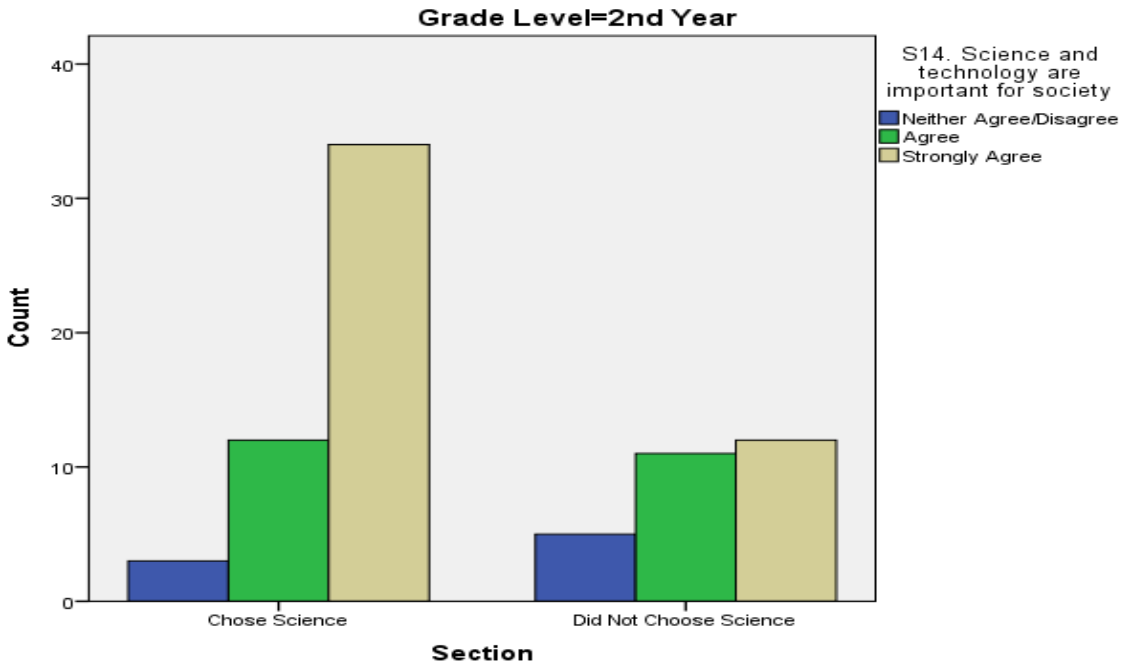
As indicated by Figure 7.1, when asked whether science and technology were important to society, some 21 first year students (57%) strongly agreed, ten agreed, four (11%) were neutral, two (5%) disagreed and only one (3%) strongly disagreed.

Table 5.2. Mean and Standard Deviation Report

Grade Level			S14. Science and technology are important for society
2nd Year	Chose Science	Mean	4.63
		N	49
		Std. Deviation	.602
	Did Not Choose Science	Mean	4.25
		N	28
		Std. Deviation	.752
	Total	Mean	4.49
		N	77
		Std. Deviation	.681

The overall mean in Table 5.2 is 4.49, which is indicative of a high level of agreement. The standard deviation is 1.121, which indicates greater variability.

Figure 7.2. S14. Science and technology are important for society – Second year students



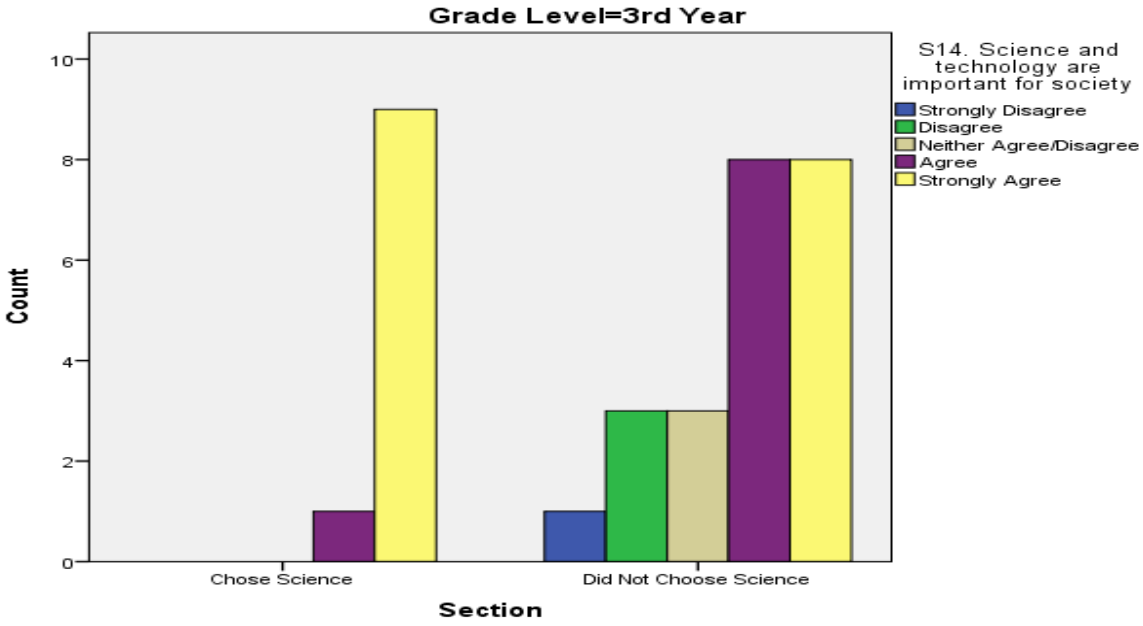
When asked whether science and technology are important to society, of the second year students who chose science, the majority (69%) strongly agreed, while 12 (25%) agreed and a very small number (6%) were neutral. Of those who did not choose science, just 12 (43%) strongly agreed, a slightly smaller number (39%) agreed and five (18%) were neutral.

Table 5.3. Mean and Standard Deviation Report

Grade Level			S14. Science and technology are important for society
3rd Year	Chose Science	Mean	4.90
		N	10
		Std. Deviation	.316
	Did Not Choose Science	Mean	3.83
		N	23
		Std. Deviation	1.193
	Total	Mean	4.15
		N	33
		Std. Deviation	1.121

The mean obtained for this group is 4.15, which indicates a high level of agreement with the statement. This group has a standard deviation of 0.899, showing reduced variation.

Figure 7.3. S14. Science and technology are important for society – Third year students



When asked whether science and technology are important to society, the majority (90%) of those who chose science in the third year strongly agreed, while one (10%) only agreed. Of those third year students who did not choose science, the majority (35%) either agreed or strongly agreed with the statement. Three students (13%) remained neutral, three disagreed and one (4%) strongly disagreed with the statement.

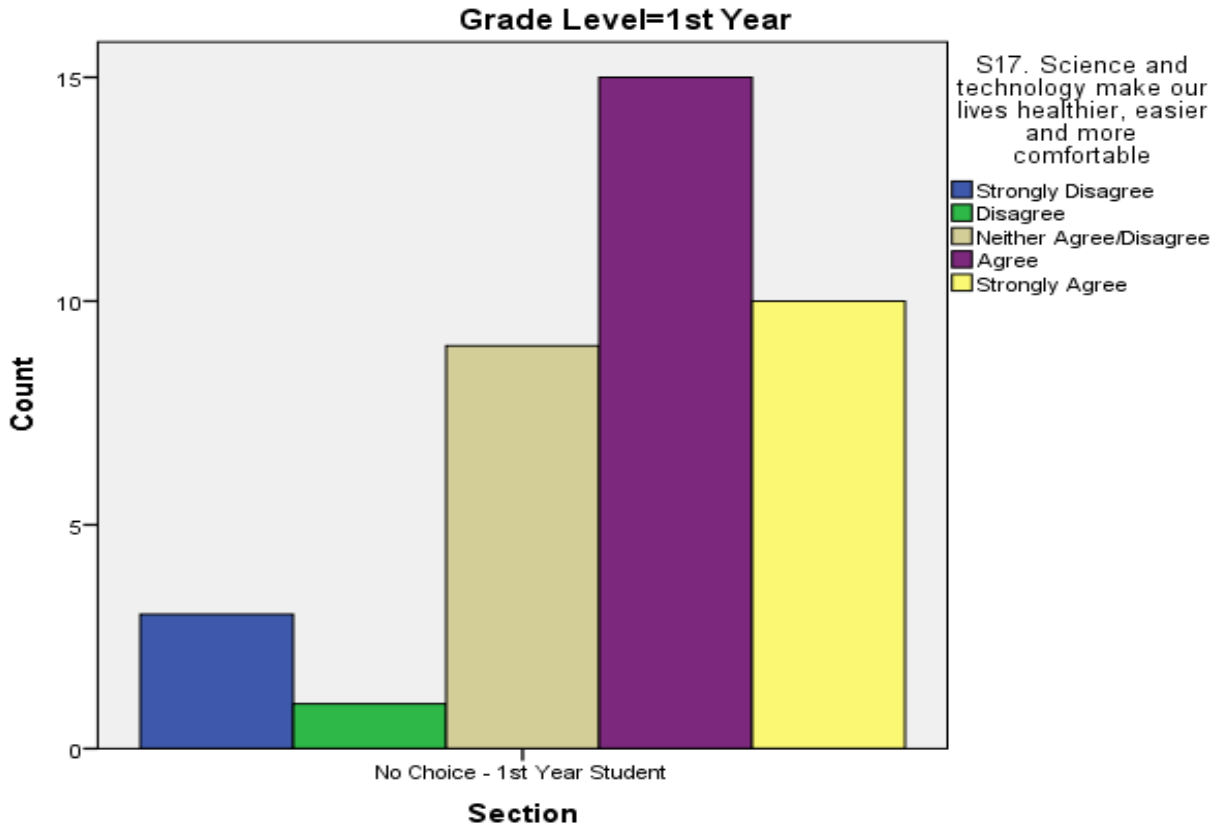
Science and technology make our lives healthier, easier and more comfortable

Table 6.1. Mean and Standard Deviation Report

Grade Level			S17. Science and technology make our lives healthier, easier and more comfortable
1st Year	No Choice - 1st Year Student	Mean	3.74
		N	38
		Std. Deviation	1.131
	Total	Mean	3.74
		N	38
		Std. Deviation	1.131

The group has a standard deviation of 1.131 showing statistical significance and variation from the mean.

Figure 8.1. S17. Science and technology make our lives healthier, easier and more comfortable – First year students



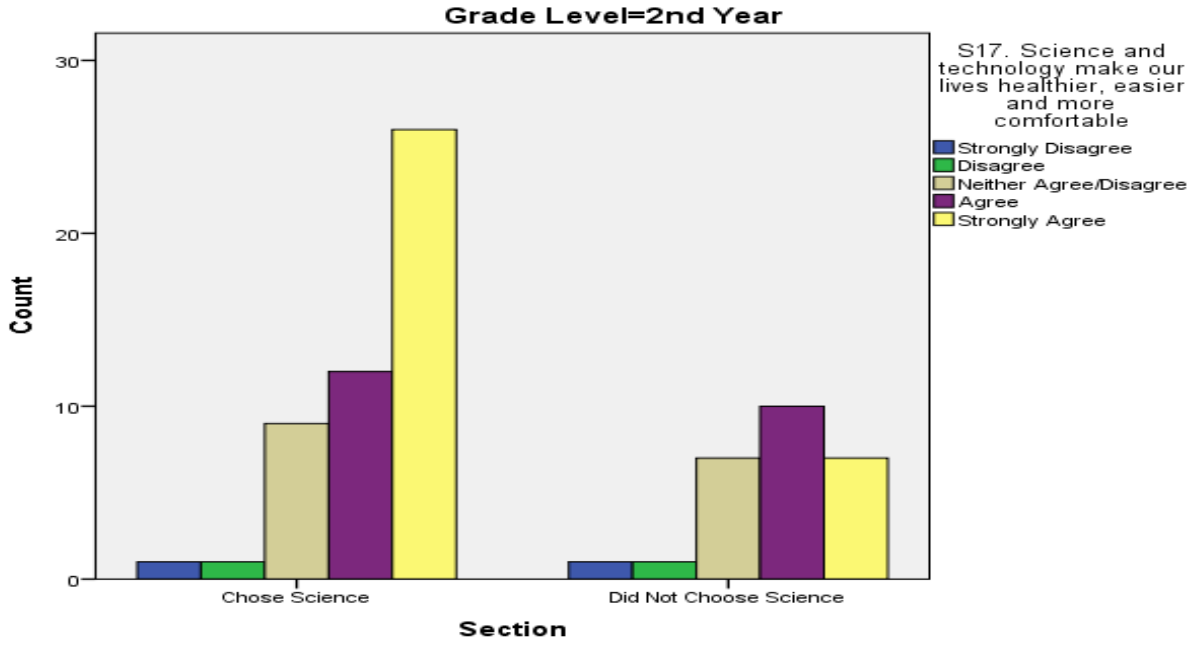
When the first year students were asked whether science and technology made their lives healthier, easier and more comfortable, the majority (39%) agreed. Ten students (26%) strongly agreed, with nine students (24%) remaining neutral. Only one student (8%) disagreed with the statement, while three (3%) strongly disagreed.

Table 6.2. Mean and Standard Deviation Report

Grade Level			S17. Science and technology make our lives healthier, easier and more comfortable
2nd Year	Chose Science	Mean	4.24
		N	49
		Std. Deviation	.969
	Did Not Choose Science	Mean	3.81
		N	26
		Std. Deviation	1.021
	Total	Mean	4.09
		N	75
		Std. Deviation	1.002

The groups' standard deviation is > 1.0, which shows both variation and statistical significance.

Figure 8.2. S17. Science and technology make our lives healthier, easier and more comfortable – Second year students



Among the second year students, when those who chose science were asked whether science and technology made their lives healthier, easier and more comfortable, the majority (53%) strongly agreed, while 13 (25%) agreed and nine (18%) remained neutral. A very small number (2%) disagreed, while the same number strongly disagreed. Of those who did not choose

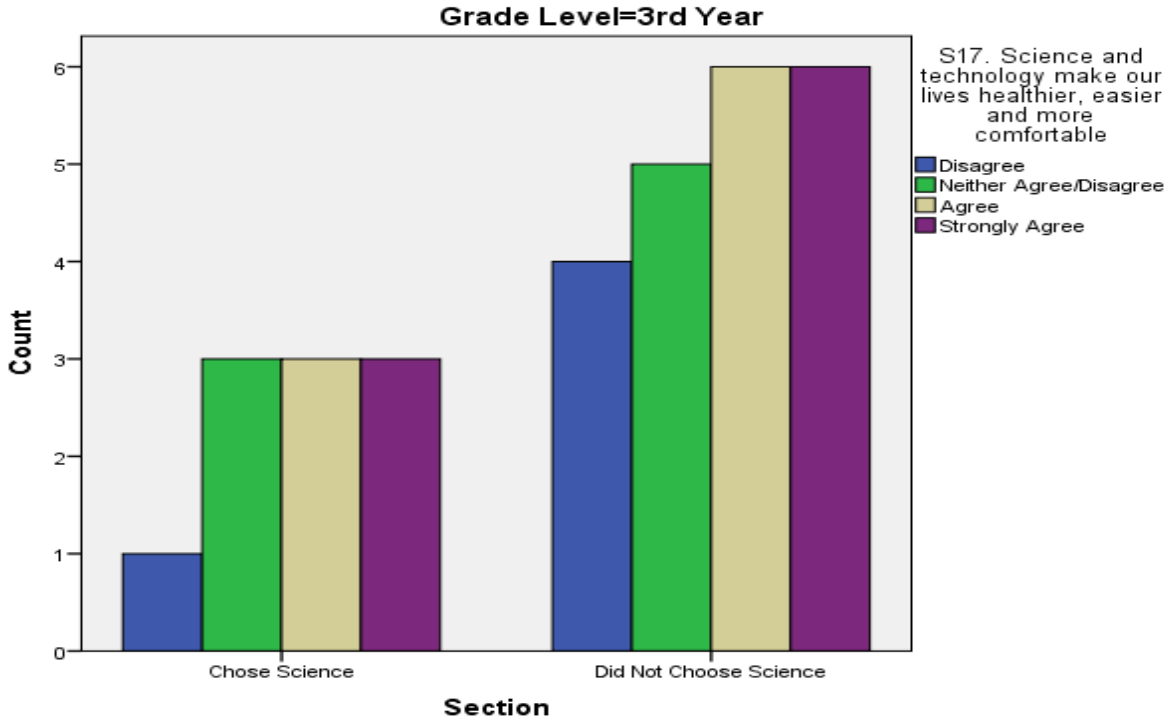
science, ten students (38%) agreed with the statement, seven (27%) strongly agreed, and seven remained neutral. Only one student (3%) disagreed with the statement and (3%) one strongly disagreed.

Table 6.3. Mean and Standard Deviation Report

Grade Level			S17. Science and technology make our lives healthier, easier and more comfortable
3rd Year	Chose Science	Mean	3.80
		N	10
		Std. Deviation	1.033
	Did Not Choose Science	Mean	3.67
		N	21
		Std. Deviation	1.111
	Total	Mean	3.71
		N	31
		Std. Deviation	1.071

The standard deviation is > 1, which indicates greater variability and proves statistical significance.

Figure 8.3. S17. Science and technology make our lives healthier, easier and more comfortable – Third year students



Asked whether science and technology made their lives healthier, easier and more comfortable, for the year three students that chose science, a half (30%) strongly agree, a similar number are neutral and agree, while a sixth (10%) disagree. For the year three students that did not choose science, almost all (29%) strongly agree or agree, over three quarters (24%) are neutral, and two thirds (19%) disagree.

When the third year students who chose science were asked whether science and technology made their lives healthier, easier and more comfortable, three (30%) strongly agreed, three agreed and three were neutral, while one disagreed. Of the third year students who did not choose science, six (29%) strongly agreed with the statement, six agreed, five (24%)were neutral, and four disagreed (19%).

Discussion

The researcher investigated the factors that impact a female student's choice to continue to study science at the high school level in Saudi Arabia. These factors have been drawn out by the use of surveys. A Likert scale was used to determine whether the respondents strongly agreed, agreed, disagreed, strongly disagreed, or neither agreed nor disagreed.

The researcher found that specific statements did have interesting answers, particularly the statements that did not show a clear attitude and tended toward neutrality. The following items led to the determination of factors that impact the choice of female students to continue studying science in high school.

First, the mean obtained represents a general agreement on the part of the first-year students that science is an interesting subject (Table 1.1). Also, in Table 1.2, the mean rating of 3.17 and the standard deviation of 1.129 indicate that the second-year students' opinions regarding science as an interesting subject tend towards neutral. The ratings of the students vary highly because the majority of second-year students who chose science were in agreement with a statement, while the majority of students who did not choose science were in disagreement with the same statement. As the researcher expected, students' interest toward the subject has an important role in their learning. Thus, more students who have an interest and passion toward science agreed with the statement.

The percentages obtained from each year level indicate that one of the reasons why students continue to study science in high school is that they feel it is an interesting subject. The results indicate the importance of students' interest in helping them improve their academic performance (Mamlok-Naaman, 2011). Many factors can clearly impact the students' interest,

such as the presentation of content, instructional techniques, and gender issues (Hofstein & Mamlok-Naaman, 2011). On the other hand, students' lack of interest in studying science results from pressure from school and the forced learning curriculum (Yang, 2010).

One question included in the survey intended to determine students' perspectives regarding the difficulty of studying science. Most of the respondents agreed that science is a difficult subject. This is one of the factors why students express disinterest toward the subject and decide not to take it during high school. Negative views of science can reduce interest in the field or create negative images that make it harder to engage students in the topics of the curriculum. Creating positive images of science and its uses increases teachers' ability to motivate students and invite participation in the classroom. However, overcoming students' preconceptions of the field requires that teachers be aware of these preconceptions upon entering the classroom.

Education of science is complicated in many ways, due to lack of motivation in students, pre-existing ideas prior to the class, alternative conceptions of science, and lack of educational tools that address students' differing needs (Tytler, 2002). In addition, teachers must assist students in overcoming ideas of how scientists and the professions of science are perceived by both the world and peers, which can create negative interest in the field of science (Oktay & Eryurt, 2012). Thus, understanding students' thinking is important for all teachers to help students learn and succeed (Levin & Richards, 2011).

Another factor likely to affect the choice of continuing with the study of science in high school is the perception that it is better than any other subject. Obviously, a majority of the students do not consider science as better than any other subjects. Most of the respondents from this group do not consider school science as their favorite, which is equated with the view that it

is better than any other subjects. This could be attributed to the fact that science teaching has not maximized learning opportunities for learners to develop positive attitudes towards science.

This confirms the need for improving science education as espoused by Hofstein and Mamlok-Naaman (2011). In helping students develop positive mentality towards science, Osborne, Simon, and Collins (2003) stressed the need to study motivation among science students. The educators need to explore students' interests, as good teaching stimulates engagement and interest in students. Students must be provided with more opportunities for practical work, discussion, and extended investigations in the sciences. In this way, the students would learn the value of science.

Moreover, an additional factor that influences the choice of the female students to continue to study science in high school is motivation. According to the results gathered, more than 50% of the respondents from first year to third year agree that they are interested in science because it helps them appreciate their natural environment. The researcher was surprised by that unexpected result, especially in students who did not choose to study science. This is because the natural environment is one of the topics included in science education. This result supports the contention of Jenkins (2006) that science makes students aware and appreciate their external environment.

Findings also indicated a high degree of compatibility between the perceptions of the value of studying science in high school and the fact that school science makes them realize the importance of the subject in their daily living. More than 75% of the respondents agree with this statement. For this particular topic, the role of the teacher is very significant in inculcating among students the importance of science in daily life. The duty of science teachers is not just to teach the subjects, but also to engage students in the educational process by giving them the

opportunity to practice the practical skills, which will give them a sense of how to deal with safety and health issues (Dillon & Manning, 2010).

The respondents showed complete agreement on the important role of science and technology in society.

A majority of the respondents recognized the role of science and technology in improving the quality of life as well. One of the factors that contributed to students' decisions to pursue science in high school is anchored in the realization that science and technology make students' lives healthier, easier, and more comfortable. It is in this aspect that the role of the teacher is significant.

Conclusion

Students around the world share common problems. The fields in STEM, including science, are perceived as unnecessary for future jobs and careers and as undesireable potential courses in secondary education. In some cases, students' perceive that the courses are too difficult, are too boring, or result in future jobs that are male dominated.

The main factors that contribute to the female students' desire to continue studying science and technology in high school are interest, attitude, and motivation. Hence, it can be seen that affective factors influence students' learning. One factor that discourages female students from continuing to study science in high school is the difficulty associated with the subject, as indicated by students' responses to the first question.

Student motivation is dependent upon teachers fostering engagement and opportunity; however, teachers are people as well, and they require motivation and engagement to improve their skills in the classroom. Schools benefit from creating positive work environments for teachers, providing them an opportunity to hone their skills in motivation and student

engagement. Students benefit from schools that focus on creating positive work environments for teachers, because the teachers are able to learn and project confidence in the classroom, which may also build that same positive outlook in the students.

Creating the future for students and increasing the number of students who succeed in science courses requires a solid understanding of motivation and engagement. While motivation and engagement occur at numerous levels, and are directly influenced by the preconceptions imparted to individuals, particularly children, the primary focus is to better understand how teachers can motivate students. Motivation, when guided by engagement and active learning styles, may increase future interest in the sciences and can assist in improving achievement.

Limitations of Findings

In this study, various limitations should be taken into consideration when interpreting the results. One limitation of this study is that it was limited to female students' perspectives toward studying high school science.

Another limitation is that this study was conducted in one high school in South Saudi Arabia, and it was confined to a short period of time. The research study described above took place from December 7, 2014, through January 28, 2015, at a high school in Najran city, Saudi Arabia. In addition, the majority of the teachers and the students were white and from middle class homes.

Recommendation for Future Research

Future research could increase the number of respondents who participate in the study and widen the scope by increasing the number of schools involved in the study. In addition, the sample could include both genders (female and male). A longer period for the conduct of the study is also recommended.

A similar study could include the whole questionnaire in order to identify all the important factors that encourage or discourage the pursuit of science in high school. The change from a 4-point to a 5-point Likert scale could have impacted the results as neutrality was added. It might have been better if the 4-point Likert scale had been retained.

Further, there was no or only little research on increasing girls' passion toward studying science and engineering, so researchers should investigate the factors that may help increase girls' passion toward studying such subjects.

APPENDIX A: Consent to Participate

Student Choice In Continuing To Study High School Science

Arwa Al Mutir, a graduate student within the College of Education at SUNY Fredonia is conducting this study as a part of the Master's Thesis Project. The study is being conducted to determine the reasons of why female student have lack of interest in studying science. Also, to examine what factors impact a female student choice to continue to study science at the high school level in Saudi Arabia. Any data collected from this study will be used as a part of the Master's Thesis Project and the results will be used only as data support for the Master's Thesis Project.

Participation in this survey is strictly voluntary. Sign the statement at the bottom of the page, which says I grant my consent to participate in this survey, you will be asked to complete the survey. The survey should take approximately ESTIMATE minutes to complete.

All information collected will be kept confidential. No names will be requested on the survey. You are free to withdraw from the study at any time without penalty. Also, you are free to skip any questions that you do not feel comfortable answering. If you have any questions regarding this survey, please contact the Principal Investigator at almu7809@fredonia.edu or my faculty sponsor at Carrie.Fitzgerald@fredonia.edu (716 673-4652). You may also contact SUNY Fredonia's **Associate Provost for Graduate Studies, Sponsored Research and Faculty Development,** Judith Horowitz at (716) 673-3335 or Judith.horowitz@fredonia.edu if you have questions or concerns about the study.

There are not any risks associated with this study and the survey items should not cause any distress or discomfort. The results of the study will be shared with Education Programs at SUNY Fredonia.

I have read and understand the consent form in its entirety, and I willingly give consent to participate in this study.

Signature Date

APPENDIX B: Instrument

Statements	Strongly Agree	Agree	Neutral/ Undecided	Disagree	Strongly Disagree
1. School science is a difficult subject.					
2. School science is interesting.					
3. School science is rather easy for me to learn.					
4. I like school science better than most other subjects.					
5. I think everybody should learn science at school.					
6. The things that I learn in science at school will be helpful in my everyday life.					
7. I think that the science I learn at school will improve my career chances.					
8. School science has increased my curiosity about things we cannot yet explain.					
9. School science has increased my appreciation of nature.					
10. School science has shown me the importance of science for our way of living.					
11. School science has taught me how to take better care of my health.					
12. I would like to become a scientist.					
13. I would like to have as much science as possible at school.					
14. Science and technology are important for society.					
15. Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc.					
16. Thanks to science and technology, there will be greater opportunities for future generations.					
17. Science and technology make our lives healthier, easier and more comfortable.					
18. Science and technology will help to eradicate poverty and famine in the world.					
19. Science and technology can solve nearly all problems					
20. A country needs science and technology to become developed.					
21. Science and technology benefit mainly the developed countries.					
22. Scientists follow the scientific method that always leads them to correct answers.					
23. We should always trust what scientists have to say.					
24. Scientists are neutral and objective.					
25. Scientific theories develop and change all the time.					

To what extent do you agree with the above statements about Science? (Give your answer with a tick on each line. If you do not understand, leave the line blank).

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