Students' Motivation to Learn Science Subjects in Saudi Universities: Gender Dynamics

Saad Zafir Alshehri[1,*]

[1]Faculty of Education, University of Jeddah, Jeddah, Saudi Arabia

*Correspondence: University of Jeddah, Jeddah, Saudi Arabia. E-mail: szalshehri@uj.edu.sa. ORICID: https://orcid.org/0000-0002-5892-2820

Received: May 22, 2025 Accepted: June 20, 2025 Online Published: June 27, 2025

doi:10.5430/jct.v14n3p70 URL: https://doi.org/10.5430/jct.v14n3p70

Abstract

This study aimed to explore the motivational factors influencing university students' engagement with science subjects in Saudi Arabia, with a particular focus on gender dynamics. Grounded in self-determination and social cognitive theories, the research employed a descriptive-correlational design to examine whether motivational levels differ between female and male students and to assess the relationship between gender and motivation toward learning science. Data were collected using an adapted version of the Students' Motivation Questionnaire. The findings revealed no significant differences in overall motivation levels between genders, nor a strong association between gender and motivation to study science. However, female students demonstrated greater confidence in managing their motivation, behavior, and performance compared to their male peers. Perceived competence was similar across genders, and self-determination did not emerge as a key motivational factor. These findings suggest that while gender differences in motivation may be minimal, female students' self-regulatory strengths warrant further attention. Additional research is recommended to explore the underlying factors that discourage women from pursuing careers in science.

Keywords: motivation, science learning, gender dynamics, self-efficacy, self-determination, perceived competence

1. Introduction

The involvement of women in higher education has increased in recent decades, which has resulted in a reduction in gender inequality in higher education (Alwedinani, 2016). While women's overall participation in higher education reveals a significant rise over these decades, there has been little change in the strong gender-based differences across various fields of study (Parker, 2015). Traditionally, women in Saudi Arabia choose subjects like education and health, while men opt for science, technology, engineering, or mathematics (Alwedinani, 2016).

Science education is regarded as essential for fostering technological advancement and economic growth (Schulze & Lemmer, 2017). Therefore, Saudi Arabia set in motion an ambitious programme focusing on Science, Technology, Engineering, and Mathematics (STEM) education which is crucial for building a knowledge-based economy (Aldahmash, Alamri, Aljallal & Bevins, 2019). However, this initiative was launched without any agenda or clarifying its objective (Aldahmash et al., 2019). Moreover, women are not encouraged to pursue science or technology and therefore are inadequately represented within STEM occupations due to cultural norms that are reinforced from parents, teachers, and society as well as institutions that determine the decision-making process (Afiouni & Karam, 2017).

1.1 Statement of the Problem

Most studies on gender differences are linked to academic performance, focusing on whether males and females have equal access to post-graduate employment (Stoet & Geary, 2015). Moreover, studies have frequently acknowledged that science is a male domain. However, the reason why women choose science subjects has not yet been analysed.

Very few studies speak about gender inequality in education in Saudi Arabia (Alqahtani, 2020; Alsuwaida, 2016). There is scarcity of research focusing on women studying science in universities in Saudi Arabia. Most of the existing studies have focused on subjects from Western countries and therefore may not be representative of the population chosen for this study. These studies have also not focused on students' proximal social environment or motivational factors in a conservative society. Therefore, there is the need to examine gender differences in other cultural contexts where research has been relatively scarce and where cultural limitations and gender inequality has marginalised women in education related decision making (Alqahtani, 2020). Moreover, results of research conducted in Western societies may not be applicable to Saudi women. In this context, this study examines how gender dynamics might influence the decision-making process of female university students when selecting science-related subjects in Saudi Arabia.

This study contributes to knowledge and fills the gaps in the literature regarding female students' motivation to choose and learn science in Saudi higher education institutions. It explores the self-perceptions of female students in comparison to male students in science in terms of self-efficacy and self-determination. This study also investigates the gender differences in other motivational elements of learning science such as educational and career motivation.

2. Factors Affecting Motivation to Learn Science

Motivation is the process whereby objective-guided activities are initiated and prolonged for an extended period (Cook & Artino, 2016). The factors that affect motivation help in better understanding major concepts in science in an academic setting (Albalate, Larcia, Jaen, Pangan & Garinge, 2018). Research shows that science instructors have been engaging students in science projects and experiments in order to increase their motivation in learning science (Kang, Hense, Scheersoi, & Keinonen, 2019; Salmi & Thuneberg, 2019; Kang & Keinonen, 2017; Wang, 2013).

Motivational orientation refers to the internal drive or emotions that encourage a student to participate in learning activities. These orientations encompass intrinsic and extrinsic motivation, self-efficacy, personal relevance, and self-determination (Salmi & Thuneberg, 2019; Chow & Yong, 2013). Intrinsic motivation is an inborn interest, enjoyment or desire that arises from within an individual and is an enduring force (Ryan & Deci, 2020; Iyer, 2017). This interest triggers curiosity and continued engagement in learning (Ryan & Deci, 2017). In other words, intrinsic motivation enables students to not only engage in learning but enjoy the learning process and sustain their attentiveness in the assignments for a longer period (Di Domenico & Ryan, 2017). It is different from extrinsic motivation which is driven solely by external rewards such as test results and commendation (Chow & Yong, 2013). Intrinsic motivation, on the other hand, is said to influence students' productive competencies as they are highly engaged in leaning activities (Howard, Bureau, Guay, Chong, & Ryan, 2021). In contrast to intrinsic motivation, extrinsic motivation refers to the emotional state in which learners are driven or compelled to succeed academically for reasons separate from the satisfaction or fulfilment gained from the activity itself (Howard et al., 2021). However, research indicates that intrinsic motivation is the most self-determined form of motivation, and students are more inclined to engage in science learning within an independent learning environment (Salmi & Thuneberg, 2019; Studer & Knecht, 2016).

Empirical evidence has shown that self-efficacy is linked to a learner's motivation to regulate their own learning (Ryan & Deci, 2020; Ryan, Ryan, Deci, & Jang, 2009; Wood, 2019; Bandura, 1986, 1997). Academic interest and self-efficacy are also claimed to be strong predictors of students' self-determination to learn. Schulze and Lemmer (2017) explored the relationship between students' motivation for learning science and academic performance and found that self-efficacy, active learning, and goal attainment were three motivational facets of learning science. Self-efficacy, in the context of this study, refers to students' belief that they can engage with science learning activities and achieve the desired results (Wood, 2019). It is a belief about one's competence and ability to learn a new task and perform it successfully (Bandura, 1997). Self-efficacy becomes very important especially when students lack confidence or have a fear of learning science, because of the rigors of the course, laboratory experiments and test results (Sanstad, 2018). Besides, some students struggle to understand concepts, making it crucial to develop strong self-efficacy in order to perform well in science courses (Wood, 2019). It is also claimed that students who participate more actively in inquiry-based, hands-on learning, demonstrate more interest in science careers than others who do not take part or participate less in such activities (e.g. Kang & Keinonen, 2017).

Self-Determination Theory (SDT) posits that the ability of students to set goals, monitor their learning through self-regulation and act in each situation are vital for self-determined learning (Ryan & Deci, 2020; Kaplan 2008; Reeve et al., 2008). Thus, self-directed learning, self-regulated learning, personal agency as well as competence and relatedness are factors that facilitate students' motivation (Ryan & Deci, 2020). Personal agency is the ability of learners to make choices, initiate and direct actions by controlling, adapting, and monitoring their own learning (Code, 2020). In other words, self-determination allows students to have control over the way they learn science (Wood, 2019). It is claimed that students are more likely to be motivated when they have the autonomy to choose between written work and laboratory work, as well as control over the submission of completed tasks (Salmi, 2019).

Research also suggests that if instructors encourage self-determination and confidence among students, more male and female learners will be able to pursue science without fear or anxiety of failure (Sanstad, 2018; Iyer, 2017).

Perceived competence is an individual's belief that he/she has the capability to learn and execute skills (Rodgers, Markland, Selzer, Murray, & Wilson, 2014). Therefore, perceived competence is the common core of self-efficacy and self-concept, and all these conditions and/or modalities together stimulate self-regulated learning (Wood, 2019). Self-Determination not only emphasises perceived competence but also the importance of autonomous forms of motivation to students' engagement with science-based learning activities (Wood, 2019). Research suggests that the autonomy support strategies of lecturers can lead to intrinsic motivation and students' positive attitudes towards science (Salmi & Thuneberg, 2019).

Grade or performance and achievement goals and career motivation are other factors examined in this paper. Research has demonstrated that students evince interest in science only if they are encouraged to perform laboratory experiments themselves, or if instructors support and create meaningful learning experiences (Salmi & Thuneberg, 2019; Chumbley, Haynes, & Stoyer, 2015). A Finnish study found that students who were able to plan their science-related career goals were more motivated to learn in contrast to those who were unable to clearly connect the present to the future (Kang et al., 2019). Regarding career aspirations, the results of that study also revealed that the career choice of female students who were interested in science was positively correlated with innovation-oriented career decisions (Kang et al., 2019).

2.1 The Effect of Gender on Students' Motivation to Learn Science

There is an abundance of research investigating the effects of gender on subject choices. Recent research has shown that females form a disproportionately large percentage of students enrolled in humanities majors and inadequately represented in natural sciences fields (Alwedinani, 2016; Kang et al., 2019). Science subjects are more traditionally gendered as women have demonstrated less interest in science (Su & Rounds, 2015). To be specific, females prefer biology while males favoured physics and chemistry (Kang et al., 2019). Although females in Saudi Arabia are now more likely than males to transition to higher education, the social context and educational environment in Saudi Arabia has made it more difficult for women to exercise their rights or make educational choices (Al alhareth, Dighrir, & Alharethet, 2015). Gender segregation in the selection of study subjects remains a significant issue in Saudi Arabia (Alasmari, 2020). This division is deeply rooted in societal norms and expectations, where traditional gender roles shape the academic interests and career paths that are considered appropriate for males and females (Alqahtani, 2020; Alsuwaida, 2016). In the Saudi Arabian context, women are unable to opt for science subjects on their own because of constrained choices as well as social norms and policies (Alsuwaida, 2016). Science subjects are limited to men as the traditional belief is that it is only suitable for men (Alwedinani, 2016). Overall, education is often viewed as a means of preserving cultural values, reinforcing traditional gender roles, and maintaining power structures rooted in a male-dominated society. However, there is a perspective that women's involvement in science education is strongly influenced by motivational factors (Thomas, 2017).

One of the new developments or change in the situation is that women in Saudi higher education are learning to defy social structures controlled by men and challenging gender discrimination by developing their own strategies for dealing with education related issues (Abalkhail, 2019). Recent studies have shown that Saudi parents are increasingly taking pride in sending their daughters to higher educational institutions, as more females aspire to achieve their goal of obtaining professional education in science (AlGhamdi, 2018; Ali Hadi, 2019; Alqahtani, 2020). AlGhamdi (2018) examined the perceptions of Saudi women for studying science subjects as well as their motivations and career choice aspirations. The study involving 800 female students found that Saudi girls were attracted to science disciplines (for example biology and subjects related to medicine) because they were personally relevant. However, the girls were uninterested in studying physics. The key motivational factors were confidence, enjoyment, interest, liking for science (intrinsic motivations), and achievement, performance, and competitiveness (extrinsic motivation). The study implied that strategies to improve the motivation of females could help them to understand how gender stereotypes can affect the choice of science subjects. The study found that Saudi girls received support from their families to chosen science subjects. The participants believed that studying science subjects will help them build skills and ideas that can be applied in real life, and in making career decisions. On the whole, the study found that most participants who were interviewed preferred science courses and science related jobs. These findings corroborate Ali Hadi's (2019) study that examined Saudi women studying science in higher education and found that female students had a positive self-perception about their academic abilities to learn science.

The Saudi government is also seen to be making strides by implementing gender specific aims in its educational institutions and trying to end the deeply rigid guidelines governing the lives of women (Alsuwaida (2016). The objective is to reform the education system which appears to preserve gender divisions; for example, specific stereotypes held by people and policy makers about Saudi women as well as unequal access of men and women to learning science subjects (Alqahtani, 2020; Alsuwaida, 2016). Kim and Alghamdi (2019) explored reforms pertaining to science education in Saudi Arabia and reported that the country had set in motion a new strategic plan to promote science education by making changes to the science curriculum, by encouraging scientific literacy, by training science teachers, and most importantly keeping women in mind. One of the reasons for the initiative was that Saudi Arabia's results in the Trends in International Mathematics and Science Study (TIMSS) was dismal and that scores were significantly lower as compared to other nations and ranked among the lowest in the world (Kim and Alghamdi, 2019). The impact of these changes on women's freedom to choose their educational paths and career options is yet to be determined.

2.2 Theoretical Framework

The two theories that underpin this study are social cognitive theory and SDT which use self-efficacy, perceived competence, or motivation to assume greater responsibility and control as essential for learning science. Self-efficacy was used as a construct as it is the main concept in social cognitive theory (Bandura, 1986) and refers to self-confidence. Social-cognitive theory stresses that self-efficacy is the main driver of motivated action. Self-efficacy refers to the beliefs about one's abilities or competencies to plan, manage and accomplish tasks (Bandura, 1997). In other words, an individual is not only influenced by their objectives and interests but also by the motivational desire to achieve. Research that has used social cognitive theory as a theoretical framework suggests that students are motivated to learn science because they can self-regulate their thoughts, feelings, and actions (Cook & Artino, 2016; Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011). By transforming their cognitive abilities into practical skills, they aim to achieve positive outcomes, such as earning their academic degree and achieving professional success after graduation.

Perceived competence was used as a construct as it is part of the theoretical framework of SDT (Deci & Ryan, 2002). SDT, a sociocultural motivational framework, has been shown to effectively explain why certain key classroom behaviours and variables have a greater impact on student engagement than others. SDT emphasises that autonomous motivation is key for learning science (Wood, 2019). It involves the cognitive, emotional, and rational interplay of three fundamental psychological needs: relatedness or the sense of belonging in significant interpersonal and meaningful relationships with others, autonomy or self-regulation, and perceived competence.

In sum, this study examines demographic variables, especially gender and motivational factors such as intrinsic motivation, self-efficacy and self-determination or perceived competence for learning science, students' performance, and achievement goals as well as their career goals. Although self-efficacy and perceived competence are interchangeably used, they are conceptually distinct (Rodgers et al., 2014).

3. Methodology

A descriptive-correlational research design was used to provide a snapshot of students' motivation to learn science at a higher education institution in Saudi Arabia and to describe the variables and the relationships that exists between and among students' gender and motivational components. This study does intend to find a causal relationship between the variables. The research questions that guided this study were:

Is there any relationship that exists between student's gender and motivational components?

Do female students have the same motivation toward science learning as male students?

A list of all students enrolled in at least one science course was obtained from the College of Science at the University of Jeddah, which is one of the largest colleges in terms of both student and faculty size. At the time of writing this manuscript, the University had a total of 22,296 students enrolled, including 2,386 female students and 634 male students, totalling approximately 3,020 students enrolled in science courses.

After ethics approval from the university, the students were contacted via their lecturers, SMS text, and as well as by posting research information on the university website. Following an agreement for student participation protocol, obtained through their lecturers and via SMS text and university emails the students were provided the link to Survey Monkey. Quantitative data collected from 539 students was entered and analysed using SPSS version 26 on measures of central tendency and correlations. In addition, this study is descriptive in nature, as it links findings to student demographic characteristics. Given the study's design, caution is advised when generalising the results or drawing conclusions beyond the sample population.

Because this study focuses on students’ motivation to learn science, the Science Motivation Questionnaire developed by Glynn et al. (2011) was adapted and used. The questionnaire has 5 thematic sections and a total of 24 items (see Table 3). The 5 thematic sections included: (i) intrinsic motivation, (ii) students’ confidence in their ability to control motivation, behaviour, and performance, (iii) perceived competence, (iv) students’ performance and achievement goals, and (v) career motivation. The Likert scale allowed students to specify their responses to the statements in five points: Always (5), Often (4), Occasionally (3), Rarely (2), or Never (1).

The Science Motivation Questionnaire II (SMQ II) has been assessed for its reliability and validity and Cronbach's alpha results has revealed high reliability (α>0.8) (Vasques, Yoshida, & Ellinger, & Maninang, 2018). Nevertheless, the reliability of the individual scales was again assessed by Cronbach’s alphas for the modified instrument was intrinsic motivation (0.71), students’ confidence in their ability to control motivation (0.73), behaviour and performance (0.76), perceived competence (0.76), students’ performance and achievement goals (0.71), and career motivation (0.69). A panel of 5 experts comprising of faculty members from two universities judged the content domains of the scale, thus confirming content validity.

4. Findings

The first objective of this study was to describe the distinct characteristics of the population. This consisted of the gender of the students and the science subjects they were enrolled in. The population was male (53.8%) and female (46.2%) who represent all grade levels.

Table 1. Demographic Characteristics – Gender

Gender	Frequency	%
Male	290	53.8%
Female	249	46.2%

Table 2. Demographic Characteristics - Science Subjects

Science subjects	Male	Female	Total
Physics	90 (59.6%)	69 (43.4%)	159 (29.5%)
Chemistry	90 (58.06%)	65 (41.94%)	155 (29.8%)
Earth science	45 (42.86%)	60 (57.14%)	105 (19.5%)
Biology	65 (54.17%)	55 (45.83%)	120 (22.3%)

The second objective of this study sought to identify the factors that motivate students to learn science. See Table 3 (below) which describes these findings.

The students’ motivation was assessed based on the means of their scores. The classification system developed by Andressa et al., (2015) was used: mean scores between 4.41 and 5.00 indicate a high level of motivation, 4.40 and 3.39 indicate a medium level and with means below 3.38 constituting a very low level of motivation. The results show (Table 3) that the students’ level of motivation to learning science subjects was moderate as suggested by the mean score which ranged between 3.68 and 4.12. The weighted mean scores also indicate that the students’ level of motivation was moderate.

Table 3. Factors Motivating Students to Learn Science

	Themes and statements	Mean	Standard Deviation
Intrinsic Motivation:			
1	Science is thought-provoking and exciting	4.10	0.77
2	I love learning science	4.10	0.78
3	The science I learn is important as it relates to my life	4.11	0.79
4	I am interested to know about potential scientific breakthroughs in science	4.10	0.78
5	The science I learn makes my life more consequential and meaningful	4.11	0.78
	Weighted mean	4.10	
Students' confidence in their ability to control motivation, behaviour, and performance (Self-Efficacy):			
6	I can grasp the nature, significance, or meaning of science concepts	4.10	0.78
7	I am certain that I will do well in laboratory and field work	4.12	0.78
8	I am confident that I can acquire complete knowledge and skills in science	4.10	0.78
9	I am positive that I will do well on science tests	4.10	0.77
10	I believe I can achieve a Grade Point Average (GPA) of 5.0 in my science lessons.	4.10	0.78
	Weighted mean	4.10	
Perceived competence (Self-Determination):			
11	I put in a lot of effort to learn science by connecting with teachers and peers	3.98	0.71
12	I use hands-on/minds-on approaches to learn science	3.98	0.72
13	I devote a considerable amount of time studying science	4.03	0.70
14	I study and learn science in a diligent manner	3.99	0.78
15	I am always well prepared for science exams and laboratory experiments	3.68	0.85
	Weighted mean	3.93	
Performance and achievement goals:			
16	I want to achieve high grades in my science courses	4.01	0.76
17	I feel better when I achieve a good science grade	4.10	0.77
18	High scores in science experiments matters most to me	4.10	0.77
19	I feel very content when other students accept my thoughts	4.11	0.77
20	I feel very content when I solve complex problems	4.10	0.78
	Weighted mean	4.08	
Motivation to enhance career goals:			
21	I am motivated to learn science as it provides career and job opportunities	4.10	0.78
22	I am motivated to learn science because it gives me a competitive advantage in my career.	4.10	0.78
23	I am motivated to learn science because it is beneficial for my career advancement	4.10	0.78
24	I am motivated to learn science because my future career ambitions will include science.	3.92	0.82
	Weighted mean	4.06	

The third objective was to examine the relationships between student motivation and socio-demographic variables. A two-tailed t-test was conducted to compare the means of the two groups, that is the motivation levels of female and male students. Table 4 presents the results of this analysis, including the group means, standard deviations, and p-value. Results revealed that there were no statistically significant gender differences. The p-value is greater than alpha ($p > .05$) and suggest that there are no differences in the motivation of male and female students to learn science.

Table 4. T-test and Overall Motivation Level between Male and Female Students

Items	Df	t Stat	P two-tail
1	493	-0.438	0.6614
2	493	-0.616	0.5383
3	489	-0.339	0.7351
4	493	-0.616	0.5383
5	495	-0.462	0.6445
6	493	-0.616	0.5383
7	493	-0.616	0.5383
8	493	-0.616	0.5383
9	493	-0.616	0.5383
10	492	-0.719	0.4724
11	484	0.472	0.6371
12	491	0.284	0.7768
13	480	1.201	0.2302
14	505	0.798	0.4250
15	526	6.795	0.3231
16	498	1.102	0.2711
17	490	-0.721	0.4712
18	490	-0.721	0.4712
19	490	-0.721	0.4712
20	493	-0.616	0.5383
21	493	-0.616	0.5383
22	493	-0.616	0.5383
23	493	-0.616	0.5383
24	519	1.436659	0.1514

Table 5. Motivation Themes by Gender

Themes	Measure	Male (n=290)	Female (n=249)
Intrinsic Motivation	M	4.09	4.12
	SD	0.72	0.84
Students' confidence in their ability to control motivation, behaviour and performance (Self-Efficacy)	M	4.08	4.12
	SD	0.72	0.84
Perceived competence (Motivation to assume greater responsibility and control or Self-Determination)	M	3.99	3.86
	SD	0.70	0.79
Motivation for achieving high grades	M	4.07	4.09
	SD	0.71	0.83
Motivation to enhance career goals	M	4.05	4.06
	SD	0.74	0.83

As shown in Table 5, the highest motivating factor for both male and female students was intrinsic motivation, with males reporting a mean score of M = 4.09 and females slightly higher at M = 4.12. With regard to self-efficacy, female students reported a slightly higher level (M = 4.12) than male students (M = 4.08). For perceived competence (self-determination), which reflects students' motivation to assume responsibility and control over their learning, mean scores were similar across genders, with males at M = 3.99 and females at M = 3.86. In terms of motivation to achieve high grades, male students had a mean of M = 4.07, while female students reported M = 4.09. Finally, for motivation to enhance career goals, mean scores were nearly identical, with males at M = 4.05 and females at M = 4.06.

Table 6. Correlations Between Gender and Motivational Factors

Constructs	Items	Gender r_s
Intrinsic motivation	1	0.02
	2	0.03
	3	0.01
	4	0.03
	5	0.02
Self-efficacy	6	0.03
	7	0.03
	8	0.03
	9	0.03
	10	0.03
Perceived competence	11	-0.02
	12	-0.01
	13	-0.05
	14	-0.03
	15	-0.28
Performance and achievement goals	16	-0.05
	17	0.03
	18	0.03
	19	0.03
	20	0.03
Career goals	21	0.03
	22	0.03
	23	0.03
	24	-0.06

All the variables associated with the five constructs were found to have weak correlations with gender. This suggests that there were no significant correlations between students' gender and motivational variables (Table 6).

5. Discussion

The purpose of this study was to examine the motivational factors that affect female university students in Saudi Arabia to learn science as compared to their male counterparts. Intrinsic motivation, self-efficacy, grade, and career motivation were the primary motivational factors for both genders. The results obtained show that females and males have same or moderate levels of motivation for learning science. These results do not coincide with those reported in previous studies which have reported gender disparities in science and that the levels of motivation for learning science are different for females and males (Kang et al., 2019). Overall, students of both genders had innate interest in learning science. This finding corroborates the results of a previous study (e.g., Iyer, 2017).

In addition, several studies have reported high correlations between students' interest in science subjects and career motivation (Salmi & Thuneberg, 2019; Kang & Keinonen, 2017; Wang, 2013). The results of this study indicate negative correlation between future career aspiration and motivation to learn science, especially in terms of females.

Motivation to perform and achieve high grades was also negatively correlated with gender. These results are again not congruent with the findings of previous research (Chumbley et al., 2015). Literature shows that self-efficacy and self-determination are motivational aspects of science learning (Rodgers et al., 2014; Schulze & Lemmer, 2017; Wood, 2019). Although this study supports this perspective, there was no positive correlation between males and females about self-efficacy or perceived competence. Self-determination was also the lowest motivator for learning and being successful in science courses. However, the results are positive since female students chose science subjects in order to become professionals. This in agreement with the results of prior studies from Saudi Arabia that have demonstrated that more females choose science to fulfil their career aspirations (AlGhamdi, 2018; Ali Hadi, 2019; Alqahtani, 2020).

The results have also confirmed that gender equity in education is important not only for the careers of women also for their self-confidence (Alwedinani, 2016). An important takeaway message from this research is women in Saudi Arabia appear to have dismantled the myth about gender-science stereotypes and the ill-informed perceptions and misconceptions of science as a male domain. The results have implications for women's participation in science courses as it appears to give them the voice and the power to change the narrative. The findings of this study show that women have an advantage, and that this is a promising time for them to make well-informed education choices and science-related career paths.

6. Conclusion

In conclusion, the findings of this study suggest that both male and female students in Saudi Arabia show similar motivation levels to learn science, challenging previous assumptions about gender disparities in science motivation. Female students, in particular, are increasingly pursuing science education to achieve their professional aspirations. This research highlights the ongoing shift in perceptions regarding women in science and emphasises the need for continued efforts to promote gender equity in STEM fields.

This study contributes valuable insights to the discussion about gender and motivation in science education, providing a foundation for further research on how to better support female students in these fields.

7. Limitations

The present study has some limitations which can be addressed in future research. As only a questionnaire was used in this study, further research could benefit from a mixed methods research design which allows for the use of both quantitative and qualitative research. Interviews could add depth to the study and provide better understanding of the complexity of women's educational and occupational choices and their persistence in male dominated fields. Further research could also complement a quantitative research design with a longitudinal study design and provide valuable information.

Given limited studies examining the relationships between gender and motivation levels for learning science, more research is needed in this area. Considering the results of the present study, it would be critical to explore and identify the intrinsic or extrinsic reasons why women are motivated to learn science. Future studies can be conducted in universities in other Arab countries and those findings can be compared across settings.

8. Recommendations

In order to address women's underrepresentation in science courses and the prevalent gender imbalance in Saudi education system some practical suggestions are provided. In view of the serious concerns facing STEM education, support systems must be in place to motivate and prepare students, especially women, to enter these rigorous academic disciplines. Policy makers should cultivate women's interest in science early by providing and sustaining positive classroom experiences at schools. Careers in science should be promoted by stressing the more common aspects of the profession. Policy makers should use social media to reduce gender-stereotyped beliefs and behaviours, highlight the importance of science, and portray the positive role of women in the field of science.

References

Abalkhail, J. M. (2019). Women's Career Development in an Arab Middle Eastern Context. *Human Resource Development International*, *22*(2), 177-199. https://doi.org/10.1080/13678868.2018.1499377

Afiouni, F., & Karam, C. (2017). Debunking Myths Surrounding Women's Careers in the Arab Region: A Critical Reflexive Approach. In R. G. Sultana (Ed.), *Career Guidance and Livelihood Planning Across the Mediterranean: Challenging Transitions in South Europe and the MENA Region* (pp. 55-70). Rotterdam, The Netherlands: Sense Publishers. Retrieved from https://www.um.edu.mt/library/oar/handle/123456789/34030

Al Alhareth, Y., Dighrir, I., & Alhareth, Y. (2015). Review of Women's Higher Education in Saudi Arabia. *American Journal of Educational Research, 3*(1), 10-15. https://doi.org/10.12691/education-3-1-3

Alasmari, T. (2020). Can Mobile Learning Technology Close the Gap Caused by Gender Segregation in Saudi Educational Institutions? *Journal of Information Technology Education Research*, *19*, 655/670 https://doi.org/10.28945/4634

Albalate, A. R., Larcia, H. D. S., Jaen, J. A. R., Pangan, K. R. O., & Garing, A. G. (2018). Students' Motivation Towards Science Learning (Smtsl) of Stem Students of University of Batangas, Lipa City. *People: International Journal of Social Sciences*, *3*(3), 1262-1274. https://doi.org/10.20319/pijss.2018.33.12621274

Aldahmash, A. H., Alamri, N. M., Aljallal, M. A., & Bevins, S. (2019). Saudi Arabian Science and Mathematics Teachers' Attitudes toward Integrating STEM in Teaching before and after Participating in a Professional Development Program. *Cogent Education*, *6*(1), 1-21 https://doi.org/10.1080/2331186X.2019.1580852

AlGhamdi, R. A. R. (2018). *Science and Physics for Saudi Girls: Their Perceptions, Motivations and Career Perspectives*. Curtin Theses, Science and Mathematics Education Centre, Perth, Australia. Retrieved from https://espace.curtin.edu.au/handle/20.500.11937/57087

Ali Hadi, O. (2019). *Stereotype Threat and STEM Self-Perceptions of Saudi College Women* College of Science and Health Theses and Dissertations. 292. De Paul University, Chicago, USA Retrieved from https://via.library.depaul.edu/csh_etd/292

Alqahtani, A. M. (2020). Barriers to Women's Education: Participation in Adult Education in Saudi Arabia in The Past and Present. *Journal of Faculty of Education Assiut University*, *36*(4), 38-71. Retrieved from https://digitalcommons.aaru.edu.jo/jfe_au/vol36/iss4/4

Alsuwaida, N. (2016). Women's Education in Saudi Arabia. *Journal of International Education Research, 12*(4), 111-118. Retrieved from https://clutejournals.com/index.php/JIER/article/view/9796

Alwedinani, J. A. (2016). *Gender and Subject Choice in Higher Education in Saudi Arabia*. Published Thesis, Department of Education, University of York, York, United Kingdom. Retrieved from http://etheses.whiterose.ac.uk/15372/

Andressa, H., Mavrikaki, E., & Dermitzaki. I. (2015). Adaptation of the Students' Motivation towards Science Learning Questionnaire to Measure Greek Students' Motivation Towards Biology Learning. *International Journal of Biology Education*, *4*(2), 78-93. https://doi.org/10.20876/ijobed.56334

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice- Hall, Inc. Retrieved from https://psycnet.apa.org/record/1985-98423-000

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman. Retrieved from https://psycnet.apa.org/record/1997-08589-000

Chow, S. J., & Yong, B. S. (2013). Secondary School Students' Motivation and Achievement in Combined Science. *US-China Education Review B, 3*(4), 213-228. Retrieved from https://files.eric.ed.gov/fulltext/ED542966.pdf

Chumbley, S. B., Haynes, J. C., & Stoyer, K. A. (2015). A Measure of Students' Motivation to Learn Science through Agricultural STEM Emphasis. *Journal of Agricultural Education, 56*(4), 107-122. https://doi.org/10.5032/jae.2015.04107

Code, J. (2020). Agency for Learning: Intention, Motivation, Self-Efficacy and Self-Regulation. *Frontiers in Education*, *5*, 19. https://doi.org/10.3389/feduc.2020.00019

Cook, D. A., & Artino, A. R., Jr (2016). Motivation to learn: an overview of contemporary theories. *Medical Education*, *50*(10), 997-1014. https://doi.org/10.1111/medu.13074

Deci, E. L., & Ryan, R. M. (2002). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press. Retrieved from https://psycnet.apa.org/record/2002-01702-000

Di Domenico, S. I., & Ryan, R. M. (2017). The Emerging Neuroscience of Intrinsic Motivation: A New Frontier in Self-Determination Research. *Frontiers in Human Neuroscience*, *11*, 145.

https://doi.org/10.3389/fnhum.2017.00145

Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science Motivation Questionnaire II: Validation with Science Majors and Nonscience Majors. *Journal of Research in Science Teaching, 48*(10), 1159-1176. https://doi.org/10.1002/tea.20442

Howard, J. L., Bureau, J. S., Guay, F., Chong, J. X. Y., & Ryan, R. M. (2021). Student motivation and associated outcomes: A meta-analysis from self-determination theory. *Perspectives on Psychological Science*. https://doi.org/10.1177/1745691620966789

Iyer, R. D. (2017). Uncovering Students' Motivation for Learning Science: Gender Differences in Mumbai. *Global Business and Management Research: An International Journal, 9*(3), 16-30. Retrieved from http://gbmrjournal.com/pdf/vol.%209%20no.%203/V9N3-2.pdf

Kang, J., Hense, J., Scheersoi, A., & Keinonen, T. (2019) Gender Study on the Relationships between Science Interest and Future Career Perspectives. *International Journal of Science Education*, *41*(1), 80-101, https://doi.org/10.1080/09500693.2018.1534021

Kang, J., & Keinonen, T. (2017). The Effect of Inquiry-Based Learning Experiences on Adolescents' Science-Related Career Aspiration in the Finnish Context. *International Journal of Science Education*, *39*(12), 1669-1689. https://doi.org/10.1080/09500693.2017.1350790

Kaplan, A. (2008). Clarifying metacognition, self-regulation, and self-regulated learning: What's the purpose? *Psychological Review*, *20*, 477-484. https://doi.org/10.1007/s10648-008-9087-2

Kim, S. Y., & Alghamdi, A. K. H. (2019). Female Secondary Students' and Their Teachers' Perceptions of Science Learning Environments Within the Context of Science Education Reform in Saudi Arabia. *International Journal of Science and Mathematics Education.* https://doi.org/10.1007/s10763-018-09946-z

Parker, P. (2015). The Historical Role of Women in Higher Education. *Administrative Issues Journal: Connecting Education, Practice, and Research*, *5*(1), 3-14, https://doi.org/10.5929/2015.5.1.1

Reeve, J., Ryan, R., Deci, E. L., & Jang, H. (2009). Understanding and Promoting Autonomous Self-Regulation: A Self-Determination Theory Perspective. In D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 223–244). Mahwah, NJ: Lawrence Erlbaum Associates Publishers. Retrieved from https://dev.taleafrica.com/2021/03/29/understanding-and-promoting-autonomous-self-regulation-a-self-determination-theory-perspective/?print=pdf

Rodgers, W. M., Markland, D., Selzer, A-M, Murray, T. C., & Wilson, P. M. (2014). Distinguishing Perceived Competence and Self-Efficacy: An Example from Physical Exercise. *Research Quarterly for Exercise and Sport, 85,* 527-539. https://doi.org/10.1080/02701367.2014.961050

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and Extrinsic Motivation from a Self-Determination Theory Perspective: Definitions, Theory, Practices, and Future Directions. *Contemporary Educational Psychology, 61*, Article 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Ryan R. M., & Deci E. L. (2017). *Self-determination theory: Basic Psychological Needs in Motivation Development and Wellness*. New York, NY, United States: Guilford Press. https://doi.org/10.1521/978.14625/28806

Ryan, R. M., Patrick, H., Deci, E. L., & Williams, G. C. (2009). Facilitating health behavior change and its maintenance: Interventions based on self-determination theory. *The European Health Psychologist*, *10*, 2-5. Retrieved from https://selfdeterminationtheory.org/SDT/documents/2008_RyanPatrickDeciWilliams_EHP.pdf

Salmi, H., & Thuneberg, H. (2019). The role of self-determination in informal and formal science learning contexts. *Learning Environment Research, 22*, 43-63 https://doi.org/10.1007/s10984-018-9266-0

Sanstad, E. A. (2018). *The Fear of Science: A Study of Science Anxiety and the Learning Capabilities of Adult College Students.* Theses and Dissertations. University of Wisconsin-Milwaukee, Retrieved from https://dc.uwm.edu/etd/2017

Schulze, S., & Lemmer, E. (2017). Family experiences, the motivation for science learning and science achievement of different learner groups. *South African Journal of Education, 37*(1). https://doi.org/0.15700/saje.v37n1a1276

Stoet, G., & Geary, D. C. (2015). Sex differences in academic achievement are not related to political, economic, or social equality. *Intelligence*, *48*, 137-151. https://doi.org/10.1016/j.intell.2014.11.006

Studer, B., & Knecht, S. (2016). Motivation: What have we learned and what is still missing?. *Progress in Brain Research*, *229*, 441-450. https://doi.org/10.1016/bs.pbr.2016.07.001

Su, R., & Rounds, J. (2015). All STEM fields are not created equal: People and things interests explain gender disparities across STEM fields. *Frontier in Psychology*, *6*, 189. https://doi.org/10.3389/fpsyg.2015.00189

Thomas, A. E. (2017) Gender Differences in Students' Physical Science Motivation: Are Teachers' Implicit Cognitions Another Piece of the Puzzle? *American Educational Research Journal*, *54*(1), 35-58 https://doi.org/10.3102/0002831216682223

Vasques, D. T., Yoshida, L., & Ellinger, J., & Maninang, J. S. (2018). Validity and Reliability of the Science Motivation Questionnaire II (SMQ II) in the Context of a Japanese University. *Conference: New Perspectives in Science Education 2018*, Florence, Italy. Retrieved from https://conference.pixel-online.net/files/npse/ed0007/FP/4371-ESM2889-FP-NPSE7.pdf

Wang, J., & Wang, X. (2012). *Structural Equation Modeling: Applications Using MPlus*. Chichester, UK: John Wiley & Sons. https://doi.org/10.1002/9781118356258

Wood, R. (2019). Students' Motivation to Engage with Science Learning Activities through the Lens of Self-Determination Theory: Results from a Single-Case School-Based Study. *Eurasia Journal of Mathematics, Science, and Technology Education, 15*(7), 2-22. https://doi.org/10.29333/EJMSTE/106110

Acknowledgments

There are no relevant or material financial interests or non-financial interests related to this research. The author has no conflict of interest to declare that are relevant to the content of this article.

Authors contributions

The author confirms sole responsibility for the conception, design, data acquisition, analysis, interpretation, drafting, and critical revision of this manuscript.

Funding

The author declares that there are no relevant or material financial interests or non-financial interests related to this research.

Competing interests

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

Open access