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## The influence of UAE schools initiatives on high-school students' STEM career aspirations

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### Abstract

Students' science, technology, engineering, and mathematics (STEM) career aspirations are influenced by the cultural, cognitive, and contextual factors that affect their self-efficacy, outcomes, expectation, motivation, interests, and choices (Lent et al., 1994). This study investigates the influence of the United Arab Emirates (UAE) schools on high school students' STEM career aspirations. UAE schools are considered the cultural factor, where many new initiatives and policies take place, such as the science, technology, and innovation policy and new high school equivalency policy. In this study, the students' STEM career aspirations involved the cognitive factor and the contextual factor. The participants were high school students ( $n_1=330$ ) and teachers ( $n_2=10$ ) from different schools across UAE. A concurrent mixed-methods approach used quantitative data (online survey) and qualitative analysis (semi-structured interviews). The results reveal new initiatives in schools have a strong positive impact on students' STEM career aspirations. However, some gaps occurred where recommendations were made.

**Keywords:** cultural influence, cognitive influence, contextual influence, career aspirations, STEM

## INTRODUCTION

Science, technology, engineering, and mathematics (STEM) refers to integrating disciplines, including science, technology, engineering, and mathematics. STEM education aims to prepare STEM talents to address and solve real-life problems and create new ideas and inventions using STEM skills (Ali et al., 2018). More STEM talents are needed as more jobs are available in the workforce across the globe. Many educators and policymakers worldwide have taken initiatives to reform the education system to overcome the shortage of STEM talents (Kelley & Knowles, 2016). English (2017) discussed different ways of implementing STEM education in schools, such as projects, courses, outreach programs, and events.

In order to shift the focus from dependence on oil to a knowledge-based economy, the reform of the education system in the United Arab Emirates (UAE) became one of the main goals of the country's national vision for 2030. There is a strong emphasis on science skills and knowledge to drive technological innovations; therefore, studying students' STEM career aspirations is

critical in UAE. However, the link between the education sector and job demands is very weak since more than 50% of Emirati students choose the humanities rather than science fields (Hvidt, 2016). One of the studies that discussed the shortage of UAE STEM workforce stated that only 21% of students enrolled in STEM majors where the minority of students were females (Moonsear et al., 2015). KHDA (2015) stated that the students' enrolment report indicates that 35% of students are enrolled in the STEM field versus 54% in business. In 2013, only 3% graduated in medicine and health science, while 46.9% graduated in business, social sciences, and humanities studies (Moonesar et al., 2015).

UAE centennial 2071 program is a long-term government program initiated by His Highness Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, to outline plans for building UAE's future and the country's preparation for the future generations through four aspects, namely education, economy, government development, and societal cohesion. One of the plans of UAE centennial 2071 is to adopt the best and latest educational methods by focusing on students' strengths and interests and using the best-advanced science,

### Contribution to the literature

- This study investigated the influence of the United Arab Emirates (UAE) schools on high school students' STEM career aspirations.
- The cognitive, contextual and cultural factors affect students' choices and influence their development toward STEM career aspirations.
- The cultural factors (STI policy, HSE policy, and sustainable development goals, schools' initiatives) positively influence students' cognitive and contextual factors.

technology, and engineering (UAE National Committee on Sustainable Development Goals, 2017). Furthermore, it aims to have a diversified knowledge economy by increasing productivity of the national economy, supporting national companies, investing in scientific research and promising sectors, focusing on innovation, entrepreneurship and advanced industries, and developing a national strategy to shape the future of UAE's economy. So, in order to secure the knowledge economy, UAE centennial 2071 aims to enable a generation of UAE inventors and scientists and support them in technical sciences fields (UAE National Committee on Sustainable Development Goals, 2017). Accordingly, a particular focus was placed on developing vocational and technical education and revamping the curricula where critical thinking, creativity and innovation, and problem-solving are outcomes of learning (Alfaki & Ahmed, 2015). In addition, one of the aims of UAE centennial 2071 is to have excellent education by teaching advanced sciences and technology, space science, engineering, innovation, and health sciences, while focusing on moral values and positive attitudes to enhance the professionalism of educational institutions, students' interests and prepare them for future jobs (Al Tamimi, 2021). Moreover, the national strategy for advanced innovation shifts the focus from the education sector to enhance future skills in students, to achieve UAE centennial 2071 objective of having the best talents and human capital in the world. It was emphasized that this could be achieved by embracing advanced teaching methods that employ advanced technologies to develop global talents and champions and equip students with 22<sup>nd</sup> century skills (UAE Government, 2017). Therefore, educational institutions are encouraged to work on developing students' STEM career aspirations and to incubate entrepreneurship and innovation (UAE National Committee on Sustainable Development Goals, 2017). Accordingly, this study investigates the influence of students' career aspirations by exploring the teachers' roles in implementing schools' initiatives, programs, and policies (cultural factors); and explaining how the meaningful learning environment enhances the promotion of students' positive attitude toward STEM through developing their self-efficacy and outcomes expectation (cognitive factors). Consequently, this leads to an increase in students' STEM interests and choices (contextual factors).

In UAE, the education system is categorized into three categories: the international curriculum, national curriculum, and vocational curriculum. The international curriculum is a borrowed system that can be implemented in international schools such as American, Australian, British, French, Indian, and International Baccalaureate (IB). The borrowed curricula are applied in language, social studies, and sciences subjects. However, the Arabic language, Islamic studies, moral education, and national social studies are applied by the national curriculum in international schools. Second, the national curriculum is the system applied by the Ministry of Education (MoE) in UAE, where all subjects' curricula are designed by MoE. Lastly, the vocational curriculum is a specialized curriculum in STEM education, where students can move to vocational schools from grade 9 to focus on the scientific STEM subjects more than humanities which can be an entry route to STEM careers in universities. In all schools, UAE education system aims to provide career guidance, bridge the gap between high school graduates and universities, and enhance the number of students enrolled in the STEM field. Accordingly, many policies have been developed, such as science, technology, and innovation (STI) policy (UAE Government, 2015) and recent MoE high school equivalency (HSE) policy. UAE-STI policy was established in November 2015 and emphasizes the increase of Emirati participation in the STEM workforce as one of the essential pillars that should be considered to develop a knowledge-based economy (UAE Government, 2015). In addition, benchmarking the students' achievement is another tool to measure the quality of education. Hence, the gap between the high school graduation requirement and the universities' entrance requirement was addressed in UAE. Thus, the need for policy to bridge the gap was identified. In 2017, the EmSAT test was introduced to benchmark grade 12 students in English, maths, and physics as an exit exam across all school curricula and a university entrance exam. In 2017, UAE MoE started working on modifying HSE policy, where physics was introduced as a mandatory subject to achieve HSE. The need for benchmarking the level of students in physics is based on the growing need in the country to increase the number of students enrolled in a STEM career path. Therefore, students' STEM career aspirations have important implications for STEM career pathways where policies can promote STEM career aspirations in UAE.

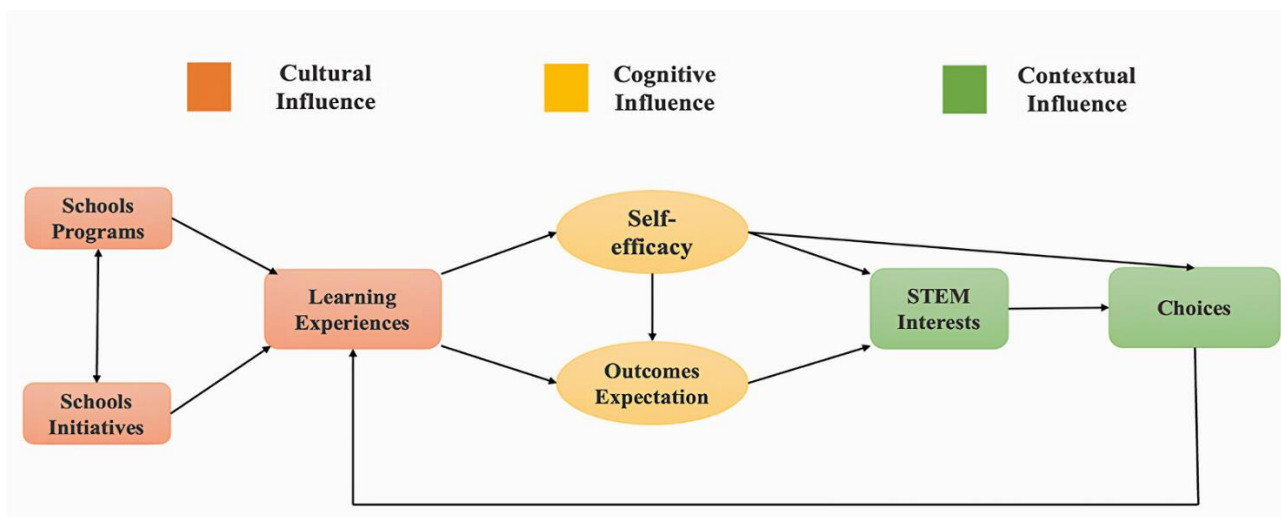


Figure 1. Adapted social cognitive career theory framework (Lent et al., 1994).

Based on the above literature, educational institutes have developed initiatives and plans to increase students’ STEM interests and develop their STEM career aspirations. In addition, several teachers’ professional training for advanced teaching methods that employ advanced technologies was provided as teachers were involved in implementing the schools’ initiatives, programs and policies. Accordingly, the current study investigates the influence of UAE schools’ initiatives on developing students’ STEM career aspirations. This study has one main question and two sub-questions formulated to fulfill the study objective:

To what extent do UAE schools’ initiatives (cognitive, contextual, and cultural factors) influence high school students’ career aspirations?

1. How are students’ cognitive factors (outcomes expectation and self-efficacy) and contextual factors (interest in STEM career choices) influenced?
2. How do the cultural factors (school environment, teachers’ roles, and policies) influence students’ career aspirations?

**Theoretical Framework**

Social cognitive career theory (Lent et al., 1994) is used as a framework to guide this study. As indicated by Lent et al. (1994), the theory aims to explain three interrelated aspects of career development:

- (1) how academic and career success is obtained,
- (2) how basic academic and career interests develop, and
- (3) how educational and career choices are made.

First, the academic and career success is influenced by the cognitive factors that include students’ self-efficacy and expected outcomes based on the personal beliefs and attitudes toward learning sciences that can be affected by teachers and the way lessons are taught.

Second, the basic academic and career interests are influenced by the contextual factors that include personal interests in specific subjects, educational experiences, and parental support. Finally, the educational and career choices are influenced by culture which includes gender, health, a person’s disposition, policy, communication, school programs, initiatives, teachers’ guidance, and learning experiences. Thus, as shown in Figure 1, the framework used for this study includes three main aspects of the theory: cognitive, cultural, and contextual influences. The cognitive factors (self-efficacy and expected outcomes) lead to the contextual factors (interests and choices) but are impacted by the cultural factors (schools’ programs, initiatives, teachers’ roles, and learning experiences). Based on the conceptual framework of the study, teachers are considered to be the core of implementing the cultural and cognitive influences that lead to contextual influence. This is because teachers were trained and involved in implementing the schools’ programs and initiatives and enhancing students’ learning experiences (cultural influence). In addition, teachers are also involved in academic and career success that include self-efficacy and outcomes expectations (cognitive influence) through teaching and learning processes to promote students’ attitudes toward STEM learning. Consequently, the cultural and cognitive influences lead to the contextual influence (increasing students’ STEM interests and career choices), which is considered to be the outcome of the study. So, to fulfil the study’s main purpose, an adapted survey was used to investigate the influence on students’ cognitive and contextual factors. The cognitive influence included in this study focuses on students’ self-efficacy and outcomes expectation to include survey items adapted from Oreshnick’s (1991) career decision-making self-efficacy scale, while the contextual influence included students’ interests in the STEM subjects that affect their choices toward STEM careers, where survey

items about students' interest were adapted from ElSayary (2014) to include STEM, science, technology and engineering, and mathematics interests. Finally, to explore the cultural factors, teachers were interviewed to understand in-depth the influence of the cultural factors (teachers' roles in implementing the schools' programs, initiatives, and policies) on students' career aspirations that set as the backbone of impacting the cognitive and contextual factors.

### **Cognitive Influence**

There are motivational factors that affect cognitive influence, such as enjoyment of lessons, outcomes expectation, and self-efficacy, that significantly predict career aspirations in STEM (Cairns & Dickson, 2021). Self-efficacy refers to a belief that learners can successfully execute the behavior required to produce the outcomes (Bandura, 1977), while outcomes expectation are considered to be the personal beliefs about the consequences of performing particular behaviors (Lent et al., 1994). Furthermore, self-efficacy is predictive of academic- and career-related goals (Rottinghaus et al., 2018). Bandura et al. (2001) mentioned that learners do not make choices of career where they do not believe they can perform in the field.

One of the studies mentioned that students with a higher self-efficacy in science are more likely to select STEM courses as electives in high school (Cairns & Dickson, 2021). Furthermore, there is a strong correlation between the students' self-efficacy and outcomes expectation, where Bandura (1997) mentioned that students who have high self-efficacy are more likely to set goals and outcomes expectation. In addition, Usher and Pajares (2008) indicated that students who have higher self-efficacy are more likely to exhibit perseverance and grit, which are considered characteristics that affect their academic attainment. It is also highlighted by Murcia et al. (2020) that the strong influence of students' outcomes expectation is from their peers, parents, and teachers.

In a study by Trujillo and Tanner (2014), teachers' influence in strengthening their students' self-efficacy was highlighted, including the sense of belonging to their classroom community. Moreover, some important characteristics of teachers that might affect students' self-efficacy, such as motivation, resilience, and self-regulation, were mentioned (Cairns & Dickson, 2021). Tan et al. (2013) explored how female students' self-efficacy and attitudes toward learning sciences are affected by teachers and the ways lessons are taught. Interesting results were shown in VanLeuvan's (2004) study, which identified some variables that affect students' science- and engineering-related career aspirations, such as locus of control, self-concept, socio-economic status, parental involvement, and parental expectation, math, and reading self-efficacy. Wang and

Degol (2017) found a direct link between students' readiness, achievement, and positive attitudes toward math and science and entering the STEM field. For instance, an exploratory study about the impact of outreach learning activities stated that school administrators and teachers work together with companies and external institutions to motivate students for the STEM domains, where teachers teach students the activities, and the ambassadors guide them and act as role models (Vennix et al., 2022). The schools' programs, initiatives, and outreach activities are considered to be the cultural influence that set as the driving force of the cognitive influence, where teachers play an essential role in implementing those initiatives and promoting students' self-efficacy and outcomes in a meaningful learning environment that will lead to the increase of students' STEM interests (contextual influence) (Tomperi et al., 2022).

### **Contextual Influence**

Contextual influences refer to various factors shaping learning experiences, personal interests, and choices (Li et al., 2019). Since students' interest in STEM careers appears to change throughout their high school career, it is vital to consider early intervention to retain their interest in their early school years (Cairns & Dickson, 2021). Burns et al. (2016) stated that students' interest in STEM careers declined in math and science from middle school onwards and indicated more significant declines in females than males. Furthermore, students who expressed interest in physics careers at the beginning of high school had the highest retention of STEM choices later on (Cairns & Dickson, 2021; Franklin et al., 2021). Shin et al. (2018) found that contextual variables, educational experiences, and parental support are vital in increasing interest in STEM careers. Another study found that personal interests and contextual variables have predictive indications of career choice making (Hui & Lent, 2018).

The need for quality STEM talents is increasingly critical worldwide and significantly crucial in raising the awareness of the importance of aspirations, particularly at an early age. Therefore, the students' STEM career aspirations have important implications for UAE and other countries in shaping the workforce and how the educational reform, policies, and mega-events can promote STEM career aspirations.

### **Cultural Influence**

Previous studies mentioned that school counselors should focus on raising awareness among students and guidance toward STEM career development, course selections, and strategic directions (Falco, 2017). Building awareness of current trends and STEM-related careers should be integrated into school life through several initiatives and events conducted in the school

(Murcia et al., 2020). Several studies highlighted that middle school students do not always receive valuable advice around STEM subjects' enrollments, and there is a need to encourage students to understand the importance of pursuing STEM subjects and their importance in their academic achievements and future careers (Falco, 2017; Hansen et al., 2017). It was highlighted in a previous study that there is a need for change in school systems to maximize students' potential in STEM subjects (Murcia et al., 2020).

On the other hand, it has been found in several studies that teachers' opinions, guidance, and encouragement can have a positive influence on students' STEM interests (Murcia et al., 2020; Wang & Degol, 2017). However, one study by Tey et al. (2020) stated that teachers do not influence students' STEM interests due to the issues found in the curriculum and school environment. Moreover, it was stated that STEM education in the curriculum heavily focuses on STEM content knowledge, where teachers are obliged to focus on teaching the curriculum as per the annual plans. As a result, students expressed that STEM learning is not interesting to them and too theoretical as the hands-on activities become limited (Ali et al., 2018). On the other hand, different students from different cultures have shown interest in the future of the globe and believe in their abilities to help in solving global problems through various actions (Badri et al., 2016). Furthermore, in a study conducted by Cairns and Dickson (2021), it was stated that there are significant implications for students' STEM career pathways and ways in which policies can promote career aspirations in STEM in UAE and also internationally. On the other hand, a recent study by Friedensen et al. (2022) conducted to examine the role of the family in the development of pre-college STEM aspirations among students with disabilities highlighted the need for more substantial scholarship on STEM pathways for students with disabilities.

## METHODOLOGY

The current study sought to investigate the influence of UAE schools on students' STEM career aspirations. The study employs a concurrent mixed-methods approach to extend the breadth and depth of the different inquiry methods. The study's rationale is to expand the breadth and range of investigations by using different methods for different inquiry components, which is called "expansion" (Johnson & Christensen, 2014).

### Participants

The study participants are two groups: high school students and high school teachers. The high school students are from grades 9 to 12 from 10 national and international schools located in different emirates across UAE. Based on the modified HSE policy requirements, it

is mandatory for all students in UAE, whether they are in national or international schools and regardless of their nationality, to take the EmSAT exams in physics, math, and English subjects in addition to other subjects they choose such as computer science, chemistry and biology. In addition, the schools' programs, initiatives, and policies were implemented in national and international schools to enhance students' interests. Accordingly, the sample involved national and international students and teachers. The intended sample size was 400 high school students; however, 330 high school students volunteered to participate in the study. Of the participants in the sample, 42.73% (141 participants) were male students and 57.27% (189 participants) were female students. Students were from different nationalities; however, the majority were Emirati students, with 54.55% (180 students), and 45.45% (150 students) were Algerian, American, British, Canadian, Dominican Republic, Egyptian, Iraqi, Jordanian, Palestinian, and Syrian. The sample was randomly selected from different schools' curricula, including 19.44% (80 students) from the SABIS curriculum, 36.11% (130 students) from the American curriculum, 13.89% (57 students) from the British curriculum, 27.78% (30 students) from MoE curriculum, and 2.78% (33 students) from IB curriculum.

The other participants were high school teachers selected from 10 schools across UAE who were invited to attend a semi-structured interview. The intended sample was 20 teachers; however, the participants who did not meet the criteria were excluded from the study. The criteria set for the participants were defined, where participants selected should:

- (1) be specialized in physics, chemistry, biology, anatomy, environmental sciences, physics, technology, mathematics, medicine, or engineering,
- (2) have five years of teaching experience or more in their professional area of expertise, and
- (3) have a degree in education.

The final sample ( $n_2=10$ ) was selected purposefully from teachers who met the criteria to have equal numbers of males and females from those teachers. The selected participants for the interview were the following from each specialization: two math, two science, two technology, three engineering, and one medicine teacher. The total number of participants who attended the semi-structured interviews was 10 teachers.

### Instrumentation

#### *High school students' survey*

The high school students were used to collect quantitative data to address the first question of the study (*how are students' cognitive (outcomes expectation and self-efficacy) and contextual factors (interests in STEM career*

choices) influenced?) The survey consisted of three main sections: demographic information where the criteria was set, cognitive influences (outcomes expectations and self-efficacy), and contextual influences (interests in STEM, science, technology and engineering, and mathematics fields). Multiple-choice questions were used to ask participants about gender, age, school curriculum, and nationality for the demographic information. The cognitive influence category only is adapted from Oreshnick's (1991) career decision-making self-efficacy scale (1991), while the contextual factors are adapted from ElSayary (2014). A five-point Likert scale was used to describe students' perceptions of the cognitive and contextual influences. For cognitive influence, the following scale was used with the outcomes expectation: 5=far too much, 4=slightly too much, 3=neutral, 2=slightly too little, 1=far too little; while the following scale is used with self-efficacy: 5=clearly describes me, 4=mostly describes me, 3=moderately describes me, 2=slightly describes me, 1=does not describe me. Regarding contextual influence, the following scale was used to describe students' interests in STEM, science, technology and engineering, and mathematics fields: 5=extremely interested, 4=very interested, 3=moderately interested, 2=slightly interested, 1=not interested at all.

The survey was handed to two specialists in education to check the qualitative content validity using a checklist developed by the researcher to give their opinions on:

- (1) the suitability of the instrument in achieving the purpose of the study,
- (2) the appropriateness of the items to which they belong to each sub-section, and
- (3) accuracy of the language used.

Suggestions received from experts were about rewording some items and removing one item that was not aligned to which it belongs. Accordingly, the final version of the survey consisted of 22 items in cognitive influence (11 items in self-efficacy and 11 items in outcomes expectation) and 24 items in contextual influence (six items in STEM career interest, six items in science career interests, six items in technology and engineering interest, and six items in mathematics interests). The internal consistency coefficient (Cronbach's alpha) was used regarding the instrument reliability. The reliability coefficient for the sub-sections was between 0.982 and 0.987, which is considered suitable for the study.

### *Semi-structured interviews*

The researcher developed the interview protocol, which comprised five semi-structured open-ended questions to address the second question of the study (*how do the cultural factors (school environment, teachers' roles, and policies) influence students' career aspirations?*).

The semi-structured interviews are designed to understand the influence of the cultural factors on students' career aspirations that included the implementation of the school initiatives, programs, teachers' roles and policies. The questions were given to two experts in school leadership, management, and policy to determine the face validity and clarity of the tool. The experts agreed on the questions; however, they suggested merging two questions that led to the same answer. The final version of the instrument was piloted with a science teacher. The science teacher was chosen purposefully as she was involved in the development of one of the school's initiatives to increase students' interests in STEM education and her response would inform on the clarity and purpose of the questions. The researcher met the science teacher via a Zoom web conference for a duration of 42 minutes to ask the interview questions. The science teacher's feedback on the interview questions was positive and her responses proved the clarity and alignment of the questions to the purpose of the study. Thereafter, no further changes were made to the final version of the tool. The science teacher's responses were not included in the study. The participants in the interview were not involved in the development of the schools' initiatives but were involved in the implementation stage. Therefore, their responses were analyzed in the study to understand in-depth the influence of these initiatives on students' career aspirations. The final version of the interview questions are as follows:

1. What experiences, information, or resources do you have to advise STEM career pathways?
2. What is your role in influencing students' STEM career interests? Give examples of initiatives and actions taken.
3. What actions are the school, ministry, or other educational authorities taking to promote students' STEM interests?
4. In your opinion, what are the main challenges in implementing the new HSE policy?
5. Is there any feedback or recommendation you would like to add?

### **Procedure**

The consent forms were sent to participants and their parents before conducting the study, and a full explanation of the purpose was provided. The data was collected concurrently using quantitative data from the students' survey and qualitative data from the teachers' interviews. The survey was designed to address the first question of the study: *How are students' cognitive factors (outcomes expectation and self-efficacy) and contextual factors (interests in STEM career choices) influenced?* It was sent to students through a web-link after receiving consent from them and their parents to describe their perceptions about the cognitive and contextual influences resulting

**Table 1.** Handal et al.'s (2013) questionnaire score range

Score range	Description
1.0<x<1.5	Very low
1.5<x<2.0	Low
2.0<x<2.5	Moderately low
2.5<x<3.0	Slightly below average
x=3.0	Average
3.0<x<3.5	Slightly above average
3.5<x<4.0	Moderately high
4.0<x<4.5	High
4.5<x<5.0	Very high

from cultural influence. A descriptive statistic was used to present mean (M) and standard deviation (SD). The researcher used Handal et al.'s (2013) questionnaire score range of means to explain the results (Table 1).

The semi-structured interview was conducted with high school teachers to address the second question of the study: *How do the cultural factors (school environment, teachers' roles, and policies) influence students' career aspirations?* Next, the interview was conducted with five open-ended questions to understand teachers' roles and implementations of the school initiatives as the cultural influence on students' STEM career aspirations.

The school's cultural influence focuses on HSE policy and the school initiatives concerning the STI policy for increasing high school students' STEM interests. Interviews were held for 30 to 50 minutes, with an average of 40 minutes. The results were analyzed using the phenomenological approach to describe the teachers' experiences and perceptions of influencing students' STEM interests. The results of both data were

represented separately, compared, and categorized into coding themes (cognitive, contextual, and cultural influences) in the discussion section to fulfill the study's main purpose, which is to investigate UAE schools' influence on high school students' career aspirations.

## RESULTS

### High School Students' Survey

The survey was conducted to understand students' perceptions of the cognitive and contextual influences. The cognitive influence included self-efficacy and outcomes expectation, while the contextual influence included students' interest in STEM, science, technology and engineering, and mathematics. The results of the cognitive influence are analyzed and categorized in Table 2 as self-efficacy and outcomes expectation. Regarding the self-efficacy category, the results show that the mean scores are "very high" in most items and "high" in two items. These two items are: I can learn what is being taught in class this year (M=3.85, SD=0.96), and when I am struggling to accomplish something difficult, I focus on my progress instead of feeling discouraged (M=3.73, SD=0.83).

For the outcome expectation, most of the items ranged between "slightly above average" and "high"; however, there are two items scored "slightly below average": 4. I seek advice from a person already employed in the field I am interested in (M=2.72, SD=1.33), and I attend extra courses outside the school that will help me in my future career (M=2.78, SD=1.36).

**Table 2.** Mean & standard deviation of the cognitive influence (self-efficacy & outcomes expectation)

	M	SD
<b>Self-efficacy</b>		
1. I can learn what is being taught in class this year.	3.85	0.96
2. I can figure out anything if I try hard enough.	4.21	0.84
3. I keep trying to achieve my target, even if it is harder than I expected.	4.15	0.93
4. I am confident that I will achieve the goals that I set for myself.	4.06	0.95
5. When I'm struggling to achieve something difficult, I focus on my progress instead of feeling discouraged.	3.73	0.83
6. I believe I can succeed in whatever career path I choose.	4.12	0.88
7. I believe I can succeed in whatever college major I choose.	4.03	0.9
8. I believe hard work pays off.	4.24	0.92
9. My ability grows with effort.	4.21	0.78
10. I think that no matter who I am, I can significantly change my level of talent.	4.21	0.91
11. I can challenge myself to achieve my goals.	4.06	0.89
<b>Outcomes expectation</b>		
1. I am confident to list several occupations that I am interested in.	3.33	1.06
2. I believe that I can choose a career that will fit my preferred lifestyle.	3.76	0.99
3. I seek advice from the career/university counselor relating to the career/university I am considering.	3.12	1.17
4. I seek advice from a person already employed in the field I am interested in.	2.72	1.33
5. I get involved in a work experience relevant to my future goals.	3.24	1.30
6. I choose a major or career that will fit my interests.	4.28	0.76
7. I choose a major or career that will suit my abilities.	4.06	0.98
8. I attend extra courses outside the school that will help me in my future career.	2.78	1.36
9. I explore other majors or career alternatives in case I am unable to get my first choice.	3.36	1.30
10. I choose the major I am interested in regardless of the length of study.	3.90	1.16
11. I identify employers, firms, institutions relevant to my career possibilities.	3.06	1.40



**Table 3.** Mean scores & standard deviation of students' contextual influence

	M	SD
<b>Interests in STEM</b>		
1. I seek more information about STEM careers.	3.15	1.33
2. I believe that I am capable of having a career in a STEM area.	3.15	1.46
3. I seek appointments with the school career advisor.	2.64	1.2
4. I feel that I have all the information I need to make a career decision.	3.48	1.05
5. I am influenced by my family in my choice of career.	3.03	1.38
6. I receive career information from my teachers during lessons.	2.55	1.33
<b>Interests in science</b>		
1. I enjoy doing science work.	3.48	1.37
2. I believe I can be successful in science studies.	3.54	1.46
3. I am interested in a job in science.	3.33	1.61
4. I use science to solve real-world problems.	2.97	1.29
5. I like doing experiments to answer questions.	3.55	1.16
6. I try to do my best in science tests because I have an interest in science jobs.	3.45	1.37
<b>Interests in technology and engineering</b>		
1. I enjoy using technology and imagine making new products.	3.12	1.32
2. I believe I can be successful in engineering.	2.78	1.45
3. I am interested in a job in technology and engineering.	2.72	1.505
4. I use computers because I know I will need those skills in my future job.	3.45	1.35
5. The skills I learn while building projects (bridges, cars, robots) will help me in my future job.	2.87	1.41
6. I believe that engineering can improve things that people use every day.	3.66	1.22
<b>Interests in mathematics</b>		
1. I enjoy doing math work.	3.15	1.44
2. I believe I can be successful in math studies.	3.12	1.29
3. I am interested in a job in math studies.	2.51	1.375
4. I use math in solving real-world problems.	2.66	1.36
5. Problem-solving skills help me in my future job.	3.48	1.37
6. I try to do my best on math tests because I have an interest in math jobs.	2.63	1.39

Moreover, the contextual influence, presented in **Table 3**, included students' STEM, science, technology and engineering, and mathematics interests. Regarding students' interests in STEM, the results showed that most of the scores are "slightly above average" while there are two items scored "slightly below average". The items that scored "slightly below average" are the following: I seek appointments with the school career advisor (M=2.64, SD=1.2), and I receive career information from my teachers during lessons (M=2.55, SD=1.33).

Most items are scored "slightly above average" and "moderately high" for students' science interests. There is only one item found to be "slightly below average": I use science to solve real-world problems (M=2.97, SD=1.29).

In the technology and engineering interests category, there are three items scored "slightly above average" and "moderately high". However, there are three items scored "slightly below average": I believe I can be successful in engineering (M=2.78, SD=1.45), I am interested in a job in technology and engineering (M=2.72, SD=1.5), and the skills I learn while building projects (bridges, cars, robots) will help me in my future job (M=2.63, SD=1.39).

Regarding mathematics interest, it was found to have the lowest in the results where there are no items scored

as "high". Three items scored as "slightly above average", and three scored as "slightly below average". The below-average mean scores are the following: I am interested in a job in math studies (M=2.51, SD=1.37), I use math to solve real-world problems (M=2.66, SD=1.36), and I try to do my best on math tests because I have an interest in math jobs (M=2.63, SD=1.39).

### High School Teacher Interviews

Teachers were interviewed virtually using Zoom web conference. Their responses were categorized based on the questions presented in the interview to address the topic of cultural influences on students' career aspirations.

#### *Q1: What experiences, information, or resources do you have to advise STEM career pathways?*

Although many initiatives are taking place in schools to raise awareness and provide advice, some students do not have an interest in pursuing STEM careers. Teachers from different schools highlighted that it was not easy to share the new information about the high-school equivalency policy with parents and students, especially about having physics as a mandatory subject for graduation. However, some teachers pointed out that students, parents, and themselves started to shift the focus of the future jobs needed, especially after the

quarantine during the coronavirus (COVID-19) pandemic. Some of the responses are stated below:

Teacher 1: "The quarantine transforms how we think about the future. As teachers, we take time to cope with our challenges in teaching and learning. So, what about students who need to be prepared for any changes that might occur."

Teacher 2: "Technology became an essential part of our lives, especially after the pandemic. Many thoughts are shared with students about what the jobs will look like in the future. Life will not be the same after the quarantine of COVID-19."

Teacher 3: "Students started to look at the medical field as a priority in their future choices due to the challenges faced during the pandemic. They felt the importance of saving peoples' lives."

Teacher 4: "Some students faced challenges to taking physics as a mandatory subject in the high school as they do not have an interest in sciences. However, after the pandemic, they started to focus more on STEM subjects."

**Q2: What is your role in influencing students' STEM career interests? Give examples of initiatives and actions taken**

Teachers from different schools shared similar ways of influencing STEM career interests. They all agreed that they are working with students on a STEM project every semester where the projects cover different topics of STEM subjects. In addition, some initiatives and events are happening in schools in different forms that help influence students' STEM career interests.

Teacher 1: "We have to collaborate as teachers on planning the STEM project from the beginning of the year where each subject teacher works on the project from the perspective of their specific areas of expertise."

Teacher 2: "STEM projects become more meaningful when one teacher handles them. However, we share information in our classes with students about the career interests as part of real-life examples."

In addition, all teachers pointed out the different initiatives and events that influence students' STEM career interests. Some of the responses are stated below:

Teacher 3: "We went with students to Expo 2020 trips, which greatly impacted how they think about their future careers."

Teacher 4: "On an annual basis, we have different initiatives in the school such as: celebrating the

first Emirati who traveled to Mars, innovation year, STEM annual fairs, schools' Expo programs, competitions, educational trips, etc."

**Q3: What actions are the school, ministry, or other educational authorities taking to promote students' STEM interests?**

Teachers' responses differed based on the school curriculum and requirements for graduation. However, they shared the actions taken toward promoting students' STEM interests. Teachers' responses are stated below based on their school curriculum:

American curriculum teacher: "The new high-school equivalency policy forces students to take one science course per year (biology, chemistry, and physics) in grades 10-12, where physics became mandatory for graduation."

Other teachers from MoE curriculum school pointed out the advanced and elite tracks designed for students that offer advanced STEM courses. They mentioned that these advanced courses need proper training and specialized teachers.

MoE teacher 1: "There is a new staff this year who are specialized in the math and sciences for the new elite track in high school."

MoE teacher 2: "There is a gap between students' levels, and the courses need to be covered. We raised a request to start reviewing the curriculum and bridge the gap between middle and high school."

IB teacher: "It is not easy to increase students' STEM interests with all the new challenges and changes in the education system."

**Q4: In your opinion, what are the main challenges in implementing the new HSE policy?**

All teachers in different schools agreed that there are many challenges to implementing the new HSE policy that encourages students to focus on STEM subjects. They pointed out that university entry differs from one country to another and between governmental and international universities. They mentioned that they have students planning to pursue studies at universities in UAE and abroad, and there is much pressure to prepare all students for the assessments needed. Some of the responses are shared below:

Teacher 1: "There are too many assessments to fulfill the USA high school diploma and HSE assessments, where EmSAT is presented to be mandatory for all students."

Teacher 2: "There is not enough information about the EmSAT contents, and the practices needed to prepare students for the exam."

Teacher 3: "There are different requirements for the universities, and students traveling abroad feel the pressure of fulfilling the requirements of the high-school equivalency and the assessment required for the university entry."

Teacher 4: "The special educational need students will not be able to fulfill the new equivalency requirement. Usually, they choose physical science instead of physics, same case for low achiever students."

Teacher 5: "With no doubt, increasing students' STEM interests and integrating such topics with the school curriculum develop their higher-order thinking skills. They will explore the impact of their learning on how they view the world. The new requirements of HSE have their advantages and disadvantages in reaching this goal."

**Q5: Is there any feedback or recommendation you would like to add?**

Some of the feedback and recommendations were highlighted by teachers from different schools. All teachers feel the pressure of the new HSE policy and preparing students to fulfill the new requirements. They also agreed on and shared some critical information to prepare students for the new requirements. Some of the recommendations are stated below:

Teacher 1: "There should be a proper review of the curriculum, especially in the transition from middle to high school, to avoid any gap in students' learning."

Teacher 2: "It is essential to properly shift the focus toward students' skills development and raise awareness about STEM education. Students should be prepared to be self-directed learners, critical thinkers, problem-solvers, etc."

Teacher 3: "There should be proper plans for the students with special needs as they might not be able to study advanced STEM subjects."

Teacher 4: "There is still a gap between preparing students in high school and the way they learn in universities. Universities need to shift the focus toward preparing students for jobs that do not yet exist. We never expect that the world will be working remotely, but it happened during the pandemic."

Teacher 5: "There is high tension between developing students' 21<sup>st</sup> century skills,

international assessments, and high school graduation requirements. There should be prioritization of the needs and proper training for teachers."

## DISCUSSION

The main purpose of this study is to investigate UAE schools' influences on students' STEM career aspirations that are affected by the cognitive, contextual and cultural factors. Therefore, the discussion in this section is to answer the study's sub-questions using the theoretical framework to include three coding themes (cognitive, contextual, and cultural influences) as mentioned below, while the conclusion section clarify how the three influences led to the development of students' STEM career aspiration.

### Influence of Cognitive and Contextual Factors

The discussion in this section seeks to answer the first sub-question of the study: *How are students' cognitive factors (outcome expectations and self-efficacy) and contextual factors (interests in STEM career choices) influenced?* The results showed a higher positive influence on students' cognitive factors (specifically self-efficacy) compared to contextual factors (students' interests).

#### Cognitive factor

The cognitive factor included students' self-efficacy and outcomes expectation, where results showed a highly positive influence. However, self-efficacy is considered to be higher than outcomes expectation. These results agreed with Cairns and Dickson (2021), who emphasized the teachers' role as an essential factor in developing students' self-efficacy in STEM classes. This was also highlighted in the teachers' interviews and their role in promoting students' STEM interests that was influenced by cultural factors. Tan et al. (2013) also highlighted that teachers' advice, and the ways lessons are taught, considered cultural factors, affect female students' self-efficacy. Interestingly, it is essential to note that the sample of this study has a higher number of females than males, which concludes that the cultural factor has a positive impact on their self-efficacy. The high results of the survey items on self-efficacy emphasize that students exhibit perseverance and grit, which is also highlighted in a previous study by Usher and Pajares (2008).

On the contrary, the outcomes expectation results determined that few items showed high positive results, while others ranged between average and moderate-high results. These results did not agree with Bandura (1997), who highlighted the strong correlation between students' self-efficacy and outcomes expectation. The high results were shown in students' outcomes expectation in choosing a career that fits their preferred lifestyle, interests, and abilities regardless of the length

of the study. These are cultural factors that parents, teachers, and peers can influence. Murcia et al. (2020) emphasized the strong influence of students' outcomes expectation from their peers, parents, and teachers.

### Contextual factors

Contextual factors referred to the students' interests in STEM, science, technology and engineering, and mathematics fields. The results showed high results in students' interest in science, followed by STEM, then technology and engineering, while students showed the least interested in mathematics. Although the results showed that students' interests are higher in science than in STEM, this could be influenced by the new HSE, where physics became mandatory for high school students. Similar results were shown in a previous study, where it was mentioned that students who expressed interest in physics careers had the highest retention of STEM choices later on (Cairns & Dickson, 2021). In addition, teachers mentioned in the interview that there are many initiatives that took place in schools regarding increasing students' STEM interests, such as trips to Expo 2020, competitions, annual fairs, celebration of the first Emirati who traveled to Mars, and the innovation year celebrations. It was mentioned in previous studies that students' STEM interests are being influenced by personal interests and contextual variables (Hui & Lent, 2018), learning experiences, personal interests, and choices (Li et al., 2019), early intervention such as events, fairs, and elective courses (Cairns & Dickson, 2021), educational experiences, and parental support (Shin et al., 2018).

### Influence of Cultural Factors

The discussion of this section seeks to answer the second sub-question of the study: *How do the cultural factors (school environment, teachers' roles, and policies) influence students' career aspirations?* The teachers' interviews were conducted to collect data about the cultural factors that included implementing the new HSE policy, teachers' roles in enhancing students' STEM interests, school initiatives, and events to promote interest in STEM. Teachers shared some information about how they influence students' STEM career interests. They mentioned that they collaborate to plan for the STEM projects from the beginning of the year and how they share information about STEM careers within a theme taught. This agreed with previous studies that showed the positive influence of teachers' opinions, guidance, and encouragement of STEM careers on students' interests (Murcia et al., 2020; Wang & Degol, 2017). One study contradicted these studies and reported that teachers do not influence students' choices and interests (Tey et al., 2020).

Other teachers shared the positive impact of some events and initiatives on increasing students' STEM

interests, such as the Expo 2020 trip, celebrating the first Emirati to travel to the Mars, innovation year, STEM annual fairs, and other extra-curricular programs. This is aligned with a previous study that highlighted the importance of raising awareness of current trends and STEM-related careers by being integrated into school life through several initiatives and events conducted in the school (Murcia et al., 2020).

Teachers mentioned the challenges and worries of implementing the new HSE policy, where physics became mandatory for high school graduation. A previous study mentioned that students interested in physics careers at the beginning of high school had the highest retention of STEM choices later on (Cairns & Dickson, 2021; Franklin et al., 2021). In addition, they mentioned that other advanced STEM courses were introduced in the high school as electives that students could feel free to choose from. Interesting results were found in a study by Murcia et al. (2020), who emphasized the need to change the school systems to maximize students' potential in STEM subjects.

Another new requirement that has been initiated is the issuing of the EmSAT assessment, which became mandatory for students' university entry in UAE. Teachers mentioned that integrating STEM content while promoting students' interests within the school curriculum develops students' creativity. However, there is a tension that teachers feel between developing students' higher-order thinking and preparing them for the international assessments. A study by Ali et al. (2018) reported similar results about the impact of focusing on STEM content knowledge to raise students' achievements and the ignorance of the hands-on activities and applications. In the same study, it was mentioned that students' interest in STEM subjects had decreased, and they viewed these subjects as theoretical concepts. Furthermore, Cairns and Dickson (2021) mentioned the crucial implications for students' STEM career pathways in which policies can promote career aspirations in STEM in UAE and internationally.

Teachers mentioned that students' interests in STEM careers have increased after the quarantine of the pandemic, where they have witnessed the importance of the medical field in saving people's lives and the importance of technology in facilitating people's work. Similar results were found in a study by Badri et al. (2016), who emphasized that students from different cultures have shown interest in the future of the globe and believe in their abilities to help in solving global problems. In addition, they expressed that the students with special educational needs were left out as they had not chosen any of the advanced STEM subjects in high school, and they expressed the need for flexibility for those students in high school. This agrees with a previous study that highlighted the need for more substantial scholarship on STEM pathways for students with disabilities (Friedensen et al., 2022).

Teachers also expressed their worries about students' transition from middle to high school and from high school to university level. They mentioned that there should be a proper review of the school curriculum to bridge the gap in students' learning. The same issue was highlighted by several studies that emphasized students' need to raise awareness toward STEM subject enrollments and the importance of pursuing these subjects in middle and high school for their academic achievements and future careers (Falco, 2017; Hansen et al., 2017).

## CONCLUSION

The purpose of this study is to investigate the influence of UAE schools' initiatives, including cognitive, contextual, and cultural factors, on high school students' career aspirations. Students' STEM career aspirations became a desire in the educational system worldwide. The cognitive, contextual and cultural factors affect students' choices and influence their development toward STEM career aspirations (Lent et al., 1994). Accordingly, UAE has started many initiatives to increase students' interest in STEM careers, such as the STI policy, the new HSE policy, and sustainable development goals in addition to the schools' programs and initiatives planned and implemented. These are considered to be the cultural factors that influence the cognitive outcome expectations and self-efficacy) and contextual factors (interests in STEM career choices).

Specifically, the cultural factors investigated in this study were the influence of teachers' guidance, school initiatives and plans, and new policies implemented. This study revealed that cultural factors positively influence students' cognitive and contextual factors. However, some gaps occurred that need to be bridged to better prepare students for the STEM workforce. For instance, a gap was found between middle school and high school students' learning. It is highly recommended to start the intervention from an early stage to enhance students' choices toward STEM subjects. The quarantine of the COVID-19 pandemic is considered one factor that influenced students' career aspirations.

The students' self-efficacy is higher than students' outcomes expectations in the cognitive factor. These factors influence students' interests and beliefs about their future careers. Results found that teachers play critical roles in promoting students' STEM career choices. However, students with special educational needs and learning difficulties were left behind by the new policies. It is recommended the importance of having new plans for those students to have the choices that suit their abilities and interests is highlighted.

Regarding contextual factors, it was found that students have very high interests in science fields, followed by interests in STEM, technology, and

engineering, while students were least interested in mathematics. The results conclude that the new HSE policy positively influences students' choices; however, there is a need for more time to show the impact on the coming generations of students.

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