The Factors Motivating Students' STEM Career Aspirations: Personal and Societal Contexts

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Abstract

Students' STEM career aspirations have received increasing attention worldwide. To understand students' perspectives toward science in terms of their STEM career aspirations, researchers in the present study analysed the data collected from participants' Qualtrics survey responses. The participants in this study were 9th to 12th grade students (*n*=44) who voluntarily participated in a one-week STEM camp for which they were offered admission as a result of winning the state science and engineering fair in Texas. The collected data were analysed using thematic analysis along with supplementary analysis of frequency distributions to determine how these motivated students' perspectives toward science influenced their decisions to pursue or avoid STEM-related careers. Results revealed that 79.4% of these students were interested in pursuing STEM careers. Of those who selected STEM careers for their future employment, the perspectives they held regarding science that motivated their STEM career aspirations were mainly divided into two contexts – personal and societal. Students who possessed a personal context fell into one of three themes: positive emotion, personal development, and developing tools for the job. Students whose perspectives best reflected a societal context were also divided into three themes: helping people, interacting with others, and impacting the world.

Introduction

Providing K-12 students with a comprehensive and engaging science, technology, engineering, and mathematics (STEM) education has been considered critically important for the 21st century economy in the United States and abroad to ensure competitiveness and prosperity. The emphasis on STEM education is critical as an increasing number of jobs necessitate STEM-related skills. In 2014, about 20% of all U.S. jobs (26 million) required significant STEM-related knowledge and skills, and the demand for employees with STEM-related expertise is growing (National Science Board [NSB], 2015). More specifically, studies have shown that STEM careers, or occupations in STEM-related fields such as biology, computer science, engineering, mathematics, medicine, and physics lack the number of skilled individuals needed to fill such positions (Wang & Degol, 2014). To meet this growing demand for additional employees in the STEM sector, the U.S. has attempted to foster a strong STEM-capable workforce and to emphasise STEM education (e.g., Texas Education Agency [TEA], 2017).

Despite the overall efforts to influence students' interests in STEM majors and careers through the incorporation and emphasis on STEM education in U.S. classrooms, students' desires to select STEM careers continue to fail to meet demand. For example, in 2010, only 38% of bachelor's

degree holders in physical sciences chose careers in STEM occupations (U.S. Congress Joint Economic Committee, 2012). This concern regarding the lack of individuals to supply the STEM workforce is not confined to the U.S. Many European countries have also indicated that they require additional workers to fill vacant positions in STEM careers (European Commission, 2004) but have had difficulty filling these positions because university students' pursuit of STEM majors has been declining (Business Europe, 2011). As schools continue to provide a variety of STEM courses and improved STEM curriculum, hopefully the number of STEM majors and individuals entering STEM careers will increase in the near future.

Although students' education may be a contributing factor influencing their career aspirations, several other factors have been shown to influence students' STEM career aspirations. For instance, it has been found that low academic achievement, especially in science, influenced students' decisions to avoid STEM careers (Arbona, 2000). A number of researchers have also determined that affective domains that increase motivational beliefs including self-efficacy, interest, values, and identity processes impacted students' career aspirations and choices (e.g., Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000; Betz, 2007; Eccles et al., 1993; Jacobs, Davis-Kean, Bleeker, Eccles, & Malanchuk, 2005). These researchers assumed that students' academic achievement and development of positive affects in science-motivated their STEM career aspirations.

On the other hand, there are few studies in which researchers directly focused on students' perspectives related to their STEM career aspirations. Several researchers conducted a comprehensive examination of the connections between students' STEM-related education, career aspirations, and perspectives regarding their career choices at the college level (Graham, Frederick, Byars-Winston, Hunter, & Handelsman, 2013). However, the impact of STEM-related education on high school (9^{th} - 12^{th} grade) students and their career aspirations has not been fully analysed or discussed. Therefore, the purpose of the present study was to explore how high school students' STEM education and/or experiences influenced their perspectives toward the discipline of science in relation to their STEM career aspirations.

In particular, the framework of this study was grounded in the ideas present in the Social Cognitive Career Theory [SCCT] (Lent, Brown, & Hackett, 2000). According to SCCT, both personal and societal contexts influence students' career aspirations. The theory establishes that the two contexts play different roles in their effect on students' career aspirations; however, there is an intimate interrelation between these contexts: societal context embeds the personal context. Personal context is a proximal process directly leading one to pursue a career. Societal context, in contrast, does not directly influence an individual's career choices, but instead impacts one's personal context, which then determines the individual's career aspirations or choices. Exploring students' perspectives toward science in relation to their career aspirations from their personal and societal contexts could provide educators with a deeper understanding of the underlying factors that can influence students' career aspirations. Therefore, the research question framing the present study was the following: What factors related to students' perspectives toward science influenced their STEM career aspirations?

Methodology

Participants

The main purpose of this study was to investigate students' perspectives toward science in relation to their STEM career aspirations. Through this investigation, researchers aimed to determine what factors related to students' perspectives toward science based on personal and societal context could have impacted their STEM career aspirations. Therefore, we selected 44 high-achieving students (17 females & 27 males) as participants using convenience sampling (Marshall, 1997). These students were science and engineering fair winners from across the state of Texas and were enrolled in a STEM summer camp in 2016. The Texas Science and Engineering Fair is an annual science and engineering competition in which students can showcase their STEM-related research projects (Texas Science & Engineering Fair, 2018). Therefore, we assumed that these students were highly motivated toward STEM-related disciplines. The ethnic backgrounds of the participants included 26 Asians (59%), 12 Caucasians (27%), and 6 Hispanics (14%). All participants were high school students (9^{th}-12^{th} grade), and the majority were going to be entering grades 10 to 12 in the upcoming academic year. Detailed demographic factors of the students who participated in this study are presented in Table 1. Inclusion criteria were (a) participants of a STEM summer camp, (b) 9^{th} – 12^{th} grade students, and (c) high achievers in STEM subjects (science and engineering fair winners).

Table 1: Demographics for students participating in the study

		Frequency (Valid percent)
Gender		
	Female	17 (39%)
	Male	27 (61%)
Ethnicity		
	Asian	26 (59%)
	Caucasian	12 (27%)
	Hispanic	6 (14%)
Grade Level		
	9^{th}	1 (2%)
	10^{th}	10 (23%)
	11^{th}	17 (39%)
	12^{th}	16 (36%)
Total		**44 (100%)**

Data collection and analysis

An online Qualtrics survey with five open-response questions was administered to the participants to examine both their STEM career aspirations and their perspectives toward the importance of science in their future careers and personal lives. The survey provided at the beginning of the camp eliminated the immediate effect of the intervention on students' STEM career aspirations.

The following questions were selected to investigate what factors impacted their STEM career aspirations:

Q1. What do you see yourself doing 5 years from now?
Q2. What do you see yourself doing 10 years from now?
Q3. How important will science be in your future education and career/profession?
Q4. In what ways will science be important in your future education and career/profession?
Q5. In what ways will science be important in your personal life?

These questions helped students express their opinions and thoughts using their own words.

The data collected from the five questions were analysed using qualitative analysis with frequency distribution. First, frequency distribution of the types of careers that the participants were interested in was used to inform the overall implications of students' career aspirations. This initial process allowed the researchers to form two separate groups of responses: (a) those in which students both expressed interest in STEM careers and indicated that science was relevant for their future careers and personal lives; and (b) those in which students neither expressed interest in pursuing a STEM career nor indicated that science would be an important aspect of their future careers and personal lives. The researchers then reread the responses of students who both expressed interest in STEM careers and indicated that science was important component of their future careers and personal lives (n=35) several times to ensure they understood the responses and to identify significant statements within the responses that indicated students' perspectives toward science and STEM career choices. The identified statements were interpreted and codified as formulated meanings. The formulated meanings were then clustered into themes based on common content. Finally, the results were interpreted and described in terms of each particular main idea within the themes. The findings were validated by reexamining the participants' responses a second time in conjunction with the identified themes their descriptions (Meadows & Morse, 2001). The final themes and descriptions included the data that emerged during the validation process. Three experienced researchers participated in the analysis procedure and used bracketing to elicit students' perceptions (Streubert & Carpenter, 1999) of science in relation to their STEM career aspirations. The inter-rater agreement related to determining the continuous variables was .90.

Results

Frequency distribution of career choices

Table 2 contains a frequency distribution breakdown of participants' career aspirations based on their responses to Q1 and Q2. The two questions asked students what they imagined they would be doing 5 years and 10 years, respectively, from the time of completing the survey. Some students did not express any career aspirations in their responses to Q1. For example, several students mentioned that they hoped to be graduating from college or majoring in a particular field 5 years later. Likewise, several students did not mention specific careers in their responses to Q2 when describing what they expected to be doing 10 years later, instead mentioning things such as "conducting research" or "working to change the world". If a participant's responses to both Q1 and Q2 did not indicate clear career aspirations, then the participant was labelled as "Either STEM or non-STEM career". However, the majority of students did provide clear career aspirations in their responses to Q1, Q2, or both. Furthermore, of those who mentioned careers, none mentioned more than one career. Therefore, the researchers examined participants' responses to Q1 and Q2 as a unit and documented a single career preference for those who listed clear career preferences.

Table 2: Frequency distribution of career interest based on Q1 and Q2

Career	Frequency (Valid percent)
STEM Career	
Medical professional (e.g., doctor, dentist, vet)	14 (31.83%)
Biologist	6 (13.64%)
Technology professional (e.g., computer scientist)	4 (9.09%)
Engineer	3 (6.82%)
General scientist	6 (13.64%)
Architect	2 (4.55%)
Non-STEM Career	
Social scientist (e.g., psychologist, sociologist)	1 (2.27%)
Business person	1 (2.27%)
Either STEM or Non-STEM Career	7 (15.91%)
Total	**44 (100%)**

Note: The valid percentages were rounded to two decimal places.

Themes

Formulated meanings of responses for each question (Q1-Q5) from students who expressed interest in either STEM majors, STEM careers, or both were arranged into clusters, which resulted in six themes: positive emotion, personal development, tools for the job, helping people, interacting with others, and impacting the world. These themes were categorized under two main themes: personal context and societal context. Personal context referred to students' personal views regarding the importance of science in their STEM career choices. Positive emotion, personal development, and tools for the job themes were included in this main theme. Societal context referred to their perspectives from the social point of view regarding the importance of science in their STEM career choices. Helping people, interacting with others, and impacting the world themes were included in this main theme. Table 3 contains the two main themes of the thematic clusters and some examples of their formulated meanings in terms of the perspectives toward the importance of science. This table also shows the number of participants included in each theme.

Personal context

Students derived their perspectives that fit in the category of personal context from the recognition that science is an inherent component of their everyday lives. This thematic cluster was separated into three specific themes: positive emotion, personal development, and tools for the job.

Theme 1: Positive emotion

Respondents in the present study whose responses fit within this cluster focused on their emotion toward science and connected their feelings about this discipline with their STEM career aspirations. Several students expressed similar sentiments when asked to describe what science meant to them, describing science as a source of "enjoyment" and "inspiration". These students also viewed engaging with science as a personal "interest" and "hobby". Descriptions showed that these students had positive emotion toward learning, and this led to their desire to pursue STEM careers in the future. For example, a sense of the connection of positive emotion toward science and STEM career aspiration was evident in the statement of the 9th grade student, who wanted to

pursue a job related to technology. He said, "Science will be important in my personal life because I personally love when I know a fact about nature that someone else doesn't know. I always enjoy getting new information and learning anything new about the science world." This statement indicated that his enjoyment and sense of fulfillment while learning about science were his personal motivation for continuing to pursue science. Another student gave a similar response, noting, "I love learning about science and using science to create and tinker in my free time".

The indications from the two students' responses adhere to findings from prior research: students' enjoyment when interacting with science encouraged them to continue engaging with science (Pekrun & Linnenbrink-Garcia, 2012). Within the theme of positive emotion, the students' STEM career aspirations originated from their personal positive emotion toward learning science and their resulting satisfaction. As one participant mentioned, "studying science and learning how to solve problems in interesting ways [can] inspire" students to maintain their interest toward science and then pursue STEM careers. Positive emotion toward the science is related to the interest toward the STEM-related career (Dawis, 2002). This theme supports many studies in which researchers have claimed that there is a relationship between students' affect in terms of STEM education and their decision to pursue STEM careers. In particular, we could observe why students aspired to obtain STEM careers from their personal context related to positive emotion.

Table 3: Main themes and thematic clusters with examples of formulated meanings with frequency

Personal Context	*Societal Context*
Positive emotion (*n*=7)	Helping people (*n*=10)
Interest	Cure people
Hobby	Help others
Enjoyment	Contribute to society
Love	
Fuels my passion	Interacting with others (*n*=3)
Inspires me	Communicating with others
	Making a connection with others
Personal development (*n*=3)	Talking about science
Curiosity about the world	Interacting with friends and family
Inventing/Discovering new things	
Make me a more well-rounded person	Impacting the world (*n*=4)
New ideas and challenges	Building problem-solving skills
	Improve/Change the world
Tools for the job (*n*=8)	Science is everywhere
Giving me skills	Better day-to-day life
Proficient at my skills and jobs	The evolution of technology
The equipment in my toolbox for the job	Convenience
Success	Understand the world
Understand the subject knowledge	
Widening my own intellect for the job	

Theme 2: Personal development

Students whose responses were categorized into this theme considered learning science and pursuing a STEM-related job as an opportunity for personal development in areas of their daily lives such as personal health, self-confidence, and intellectual competence in areas related to their personal and career interests. The students' responses in this theme indicated that their pursuit of personal development through science began with perceiving the relevance of science in their everyday lives. For example, these students observed that we use science when "cooking for family, shopping for groceries, painting landscapes, or simply goofing off on technology". The applicability and relevance of science in students' daily lives cultivated their curiosity toward science. As a result of their curiosity toward the discipline, they chose to pursue STEM careers to develop their knowledge for improving the quality of their personal lives. The students in this theme were likely to focus on their curiosity related to science in their responses, and the responses indicated that their pursuit of scientific knowledge was motivated by their curiosity related to particular scientific questions and topics. They aspired to obtain STEM careers in the future so they would have the opportunity to continue investigating these questions and topics. Furthermore, they believed that pursuing their science-based curiosity could help with their self-development. As one example, the statement presented in Figure 1 demonstrates one student's realization of the importance of science in his daily life, his resulting curiosity in everyday aspects of science, and his STEM career aspiration for personal development:

> *Science will always be important in my life, and it always has been… Farming, ranching, mixing chemicals, and other things like that make science moderately important. I've always been curious about the world…Becoming a chemical engineer will allow me to solve problems that I have always wanted to know. Learning new scientific information to feed my curiosity makes me eager to be a more productive person. Also, through becoming a chemical engineer, I believe I can become the person I aspire to be.*

Figure 1: An example of student statement in personal development category

This theme supports the conclusions from previous studies in which researchers have claimed that curiosity is a foundational starting point that may help stimulate students' awareness of the importance of science and that may persuade students to consider STEM careers for their future jobs (e.g., Gottfried, Marcoulides, Gottfried, & Oliver, 2009; Hidi & Renninger, 2006). Furthermore, they viewed their pursuit of scientific knowledge and STEM careers as a way to positively influence their personal development. The relationship between pursuit of personal development and STEM aspiration, which is aligned with this theme, has also been identified and discussed in previous studies as a significant concept for advancing STEM aspiration research (Dabney et al., 2012).

Theme 3: Tools for the job

Participants in this theme indicated that they aspired to obtain STEM careers in order to have successful lives. For these students, science comprehension clearly represented the tool for obtaining STEM jobs or succeeding in their future STEM careers. Many responses in this theme included phrases such as "Science will be important in my life because it will be my career". These students considered science important because it "gave them skills to get jobs in STEM fields". For instance, one student wrote that through studying science, "more doors will be opened, and new jobs and career paths will be available for the individuals that take risks to try new things".

The students were aware that to be successful and competitive in STEM-related job markets, they would have to refine and to develop their knowledge as each discipline undergoes innovations. For example, students stated, "Science is always changing and keeping up with its changes will be necessary to be successful in the field", and "Every time science progresses, I will have to update my knowledge on relevant material in order to widen my own intellect, which is necessary for my future job". These students believed that adjusting to changes and innovations in the field of science would be critical for success in their future careers. Therefore, acquiring scientific knowledge was their main focus. These students viewed knowledge as a tool for the job, which was evident in the statement of a 12th grade female student who wanted to become a medical professional (surgeon). She said, "Gaining vast knowledge on the science revolving around my field will ensure my success in becoming a surgeon".

Academic achievement such as getting good grades in STEM-related classes was very important to these students. The words "knowledge", "(academic) achievement", and "success" were frequently used in students' statements contained within this theme. They connected their academic achievement with their future success in STEM careers. In particular, 11th and 12th graders tended to state the importance of science as a tool for obtaining STEM-related jobs and being successful in STEM fields.

Societal context

Students' development of societally-based perspectives often began with the recognition that science is highly relevant within society. This thematic cluster was separated into three specific themes: helping people, interacting with others, and impacting the world.

Theme 4: Helping people

Participants in this theme indicated that they aspired to obtain STEM careers to help people; through their responses, they emphasized their belief in the importance of contributing to the world. Responses in many cases directly included phrases such as "helping others", "curing people", and "contributing to society". One of the most apparent inclusions found in the responses related to future STEM career choices (Q1 and Q2) was that many students included words related to medical professionals (e.g., doctors, neurosurgeons, pediatricians, and surgeons), medical schools, and medical engineering. Participants' responses showed that most of them, in pursuing a career in which they could help people, decided to become medical professionals. For example, one student mentioned, "If I become a pediatrician, I will be able to apply my skills to help sick people, in particular the people who do not have enough money". Social convention toward medical professionals is also an important factor for students' career choices. Nearly every student who expressed interest in becoming a doctor mentioned that their experiences during childhood and adolescence with positive and encouraging doctors who took the time to explain symptoms, procedures, etc. to them influenced their decisions to pursue the profession. Doctors are professionals who translate sympathy into action in people's lives. Because of their frequent contact with doctors growing up, several of the students felt that they better understood what doctors do for people and perceived the profession as one in which your role is to both improve and save peoples' lives. From these students' perspectives, science is directly used to diagnose illnesses, and acquiring scientific knowledge to cure people was essential to them. For instance, one student viewed science as "basic knowledge required to understand the human body", and thought that proficiency in science would allow her to "effectively help others by becoming a good

doctor". The students realized they could not become doctors without a comprehensive understanding of science. This realization may have influenced the importance of academic achievement among students in this thematic cluster.

Theme 5: Interacting with others

Participants in this theme focused on the opportunities to interact with others in STEM areas. Due to the relevance of STEM disciplines and topics in the 21st century, there is a greater importance placed on sharing and discussing STEM-related subjects and ideas. Therefore, the ability to intelligently contribute to STEM-related discussions is useful and important. One student in this theme acknowledged the value of intellectual discourse when discussing her interest in STEM, mentioning that, "Being able to have an intelligent conversation is very important to make a connection with others". In the same vein, other respondents indicated that they wanted to pursue STEM careers because they viewed STEM occupations as instruments through which they could communicate with others about important 21st century ideas and topics. These students demonstrated the importance of having comprehensive scientific knowledge, and learning about scientific concepts and topics to obtain STEM-related jobs and effectively discuss relevant 21st century topics. Therefore, the students became interested in science due to their initial interest in STEM careers. Most of these students talked about becoming general scientists. In their responses, they did not indicate a specific career they wanted to pursue, but they did express a desire to major in science disciplines. The field of science contains numerous subdisciplines, and because of this, students were unlikely to have a comprehensive understanding of every science-based major or career. Although they did not know precisely what scientific career or major they wanted to pursue, the students knew that they wanted to continue their study and engagement in science through science majors and careers.

Theme 6: Impacting the world

Participants in this theme indicated that they aspired to obtain STEM careers because they wanted occupations in which they could contribute to the development of society. One of the most noticeable points was that many students considered technology a critical factor in the development of society. Responses in many cases directly included words such as "the development of society/world", "innovation", and "technology". Most students who mentioned STEM stated that "Science is everywhere", and "STEM changes the world". One student who wanted to be a technology professional (computer scientist) stated, "Whether we see it or not, science is changing and shaping our society. It creates convenient methods to live in this society". Another student who wanted to pursue a career as an engineer also mentioned, "Science will always be inventing and discovering new things that will change how we look at the world". These students wanted careers in STEM fields because they believed their work through such occupations would allow them to bring greater convenience and innovation to the world. Other students in this category were also well aware of the interconnectedness of their career aspirations with science. In the future, they wanted to enter technology or engineering occupations such as computer programming and engineering. Several students wanted to become leaders in these fields; for example, one student wanted to develop a technology company. They believed that through working in STEM areas, especially technology and engineering, they could directly make significant contributions to their society and the world.

Some students demonstrated multiple perspectives. For example, one respondent mentioned, "Science explains literally everything in the world. I love learning about why things are the way they are, and the ability to help/contribute society beneficially will give me an inner, intrinsic sense of content and value". His responses indicated that his perceptive is a co-mingled product of personal and societal context. His perspective shows that he loves learning science because science provides him an inner and intrinsic sense of purpose. This personal context led to his desire to obtain a STEM career, and eventually he expects that his career, which is related to STEM, will contribute toward benefitting the world. People choose STEM fields and careers not only to develop their personal lives but also to hopefully contribute toward improving society. We did not consider this dual context (i.e., personal and societal context) in the present study.

Discussion

In the present study, we investigated students' perspectives toward STEM that impacted their STEM career aspirations by analyzing participants' responses using qualitative analysis with frequency distributions. Through our research, we have gained a greater understanding of both students' personal context and their societal context when they consider science and STEM career aspirations. During the study, six different themes emerged based on students' perspectives expressed in their responses and were categorized under personal or societal context. These six themes included the following: personal context-positive emotion, personal development, and tools for the job; and societal context-helping people, interacting with others, and impacting the world.

Students approach STEM career aspirations and science differently based on these themes, which are oriented toward personal or societal contexts. Students whose perspectives fit under the category of personal context first develop interest in science due to the discipline's relevance. For example, students whose initial interest in science is expressed through comments such as "I am interested in science because I have had great science-related experiences" (positive emotion), "Science helps me to become a well-rounded person" (personal development), and "Science is an important tool for my career" (tools for the job) are more likely to pursue STEM careers. These students have positive perspectives toward science and aspire to obtain STEM-related jobs to maintain their positive connection with science. Conversely, students in the thematic cluster of societal context are typically first interested in STEM careers, and this interest in STEM occupations increases the significance they attribute to science in their lives. For example, students who mainly have societal perspectives tend to initially pursue STEM careers and then think about the importance of science within the STEM careers they selected. Statements like "I know the importance of science, which is used in STEM careers to help people (helping people); to engage people in discussions of 21st century STEM-related topics (interacting with others); and, to contribute to the development of society (impacting the world)." These different connections between students' STEM career aspirations and their personal/societal perspectives suggest the importance of the consideration of both personal and societal perspectives.

Students' perspectives toward the importance of science from their personal and societal perspectives are proximal factors that influence critical STEM career aspiration junctures. Interaction among personal perspectives including internal cognitive and affective states and societal perspectives such as external environmental factors make students become "both products

and producers of their environment" (Wood & Bandura, 1989, p. 362) with the potential for personal agency in their career choices (Lent et al., 2012). In particular, the transactions occurring between persons and their environments develop individuals' perspectives toward academic areas, and then become a fundamental cause of their career aspirations (Osipow, 1990). Previous studies (e.g., Betsworth & Fouad, 1997) as well as evidence from the present study indicate that students' perspectives toward science can influence their vocational interests, which are important determinants of career aspirations. However, results from this study also reveal that, in some instances, students' vocational interests were important determinants of their perspectives toward science. The results from this study support the ideas of SCCT, which establishes the concept that personal and societal contexts have a significant influence on the development of students' career aspirations. Identifying and understanding students' perspectives from a personal context helps determine the direct factors influencing both their career aspirations and decisions. On the other hand, Identifying and understanding students' perspectives from a societal context may allow educators and researchers to obtain more effective ideas on how to stimulate positive perspectives from students' personal context. In addition, the results of this study indicate that students' societal context may have a direct influence on their STEM career aspirations. The implications of this finding regarding societal context differ slightly from the description and understanding of societal context within the SCCT framework, in which societal context directly influences personal context and personal context directly influences an individual's career choices. Because both students' personal and societal perspectives arise from their experiences (Rudduck & Flutter, 2000), understanding how students' experience became an initial cause of their perspectives can provide important information for educators who can then make informed decisions regarding instructional and curricular changes and reform. Personal and societal perspectives are formed from students' positive experiences.

The results indicate that students' perspectives toward the importance of science and STEM career aspirations are influenced by their positive personal experiences related to science or particular STEM careers. Positive experiences lead to positive perspectives toward subject knowledge of a discipline and then STEM careers (Osipow, 1990; Rudduck & Flutter, 2000). That is, positive experiences lead to positive perspectives toward particular STEM careers, which can then lead to positive perspectives toward science. Therefore, accessibility to STEM-related situations is important for students' STEM career aspirations. Providing an opportunity to approach from the other context (personal/societal) can help students broaden their perspectives and maintain their pursuit toward STEM-related careers. Educators need to be aware of this and facilitate many opportunities for increasing and motivating positive perspectives toward science and choosing STEM careers. Teaching methods that positively impact students' perspectives toward STEM education and careers need to be considered. Because accessibility and practicality lead students to gain a positive perspective toward science and aspirations of STEM careers, teacher need to employ engaging STEM activities. These activities may encourage students to develop positive personal perspectives related to the present study's personal context themes of positive emotion, personal development, and tools for the job as well as societal perspectives such as helping people, interacting with others, and impacting the world. Therefore, the results from the present study suggest the importance of pedagogical strategies that promote providing students with experiences related to STEM topics and careers.

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