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Incorporating Entrepreneurial Practices into STEM Education: Development of Interdisciplinary E-STEM Model in High School in the United Arab Emirates

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ABSTRACT

STEM education has been emphasized in the UAE education reform because science, technology, mathematics and engineering are considered as the main disciplines that reflect the development of a country's economic situation. Although STEM education benefits all students, its professions do not stimulate them all. Students have the right to pursue any other career that satisfy their ambition. For more effective STEM implementation in its early stage in the UAE, there is a need for a practical E-STEM model to guide STEM educators to integrate entrepreneurial practices into their existing STEM courses to enhance students' entrepreneurial act. An exploratory sequential design was conducted through mixed-method approach to collect qualitative data from 12 STEM leaders regarding how entrepreneurial practices could be incorporated into STEM education. Moreover, quantitative data was collected from 134 Science, Technology, Mathematics and Business teachers regarding the challenges that might eliminate this incorporation in the UAE. Results revealed that experiential learning through competency-based practices is the best approach to adopt interdisciplinary E-STEM model with high school students. However, some E-STEM challenges were highlighted to be examined in the future research such as lack of STEM teachers' knowledge about entrepreneurial learning. Further studies are recommended to investigate the impact of the developed interdisciplinary E-STEM model on enhancing students' entrepreneurial competencies.

1. Introduction

There has been a consistent emphasis for more technical applications, innovation and creativity in the educational practices to enrich the STEM professions (Asghar, Ellington, Rice, Johnson, & Prime, 2012). Attention given to this concern is supposed to produce the essential tools for the national development as well as industrialization through expanding the habits of scientific attitudes that help students steadily acquire the constructive reasoning skills and become more confident in inquiring into real-life problems (Aguele & Agwagah, 2007). Hence, entrepreneurship and innovation are critical contributors to the economic prosperity of the country. The most natural strategy of stimulating real-life applications that enhance students' productivity is the reinforcement and development of students' skills through integrated disciplines (Adeyemo, 2009). Interestingly, integrated curricula in general, STEM education in particular has great potential to promote students' learning opportunities by connecting the classroom objectives

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and tasks to the most relevant real applications outside the school. Despite this, the ultimate meaning of curriculum integration is still ambiguous and consistently debated (Shaer, Zakzak, & Shibl, 2019), the most effective integrated curriculum is the one that reduces, minimizes or blurs the boundaries between disciplines (Beane, 1995). The number of research studies concerned with integrated pedagogical practices in different levels of education is growing steadily in international literature (Öztürka & Olgana, 2016). Consequently, the literature discussed the importance of integrating entrepreneurial learning with existing STEM courses applied in schools (Ezeudu, Ofoegbu, & Anyaegbunnam, 2013) to enhance students' awareness regarding the value of their STEM designs and encourage them to act more entrepreneurially (Hershman, 2016; Winkler, Troudt, Schweikert, & Schulman, 2015). Furthermore, (Eltanahy, Forawi, & Mansour, 2020) found that business teachers should be collaborated with STEM teachers to support infusing entrepreneurial practices into STEM education because they are more aware of entrepreneurial practices than STEM teachers. However, none of the studies concerning this incorporation developed a practical E-STEM model to guide teachers for successful implementation. The purposes of this inquiry are to explore restructuring the existing STEM curriculum in the UAE to accommodate business practices into its courses or projects, to develop a new E-STEM model that incorporate entrepreneurial practices into STEM education, and to investigate the main challenges that might eliminate incorporating entrepreneurial practices into STEM education.

- How STEM curriculum could be restructured to infuse entrepreneurial practices into its applications?
- What are the main challenges that might prevent incorporating entrepreneurial practices into STEM education in the UAE?

2. Theoretical Framework

Incorporating entrepreneurial practices into STEM education requires integrating pedagogical methods from both disciplines. Essentially, it needs a relevant combination of teaching and learning practices from STEM education and entrepreneurship courses (Sidhu, Iqbal, Fred-Ojala, & Johnsson, 2018) to produce new E-STEM model. Therefore, competency-based approach (CBA) as a constructivist approach is relevant because of the current educational necessity to apply successful pedagogical conditions (Eltanahy et al., 2020) that enhance students' acquisition of the cognitive and non-cognitive core competencies that enable them to cope with ever-changing life situations (Dedovets & Rodionov, 2015). Social constructivist theory explains how knowledge could be acquired, constructed and developed when students are actively working in groups or peers to share ideas and build on their prior knowledge (Vygotsky, 1987). Thus, integrated knowledge-based constructivist learning has its potential for enhancing the school environment (Mayer, 2004) because it can fit in different learning experiences such as problem-based learning (PBL), project-based learning (PjBL) (Han, Yalvac, Capraro, & Capraro, 2015) and Inquiry-based learning (Eltanahy & Forawi, 2019). Although integrating knowledge from different subjects is challenging (Wilson, 2008), interdisciplinary theory indicates that this integration provides students with more meaningful learning tasks and enhance their abilities to solve complex problems (Jacobs, 1989). Since it is not easy for high school students to communicate directly with the labor market, education-through entrepreneurship is perceived as the best approach to embed entrepreneurial practices into any other course curriculum because this approach focuses on the pedagogy and the method rather than the content knowledge (Johannisson, 2010).

3. Literature Review

The urgency to enhance improvement and achievement in education related to science, technology, engineering and mathematics becomes evident by the massive reform programs that have given all its focus to STEM disciplines and its applications that should meet the workplace requirements (Shaer et al., 2019). It was suggested that reform applications should be embedded at the school level to ensure its success (Palmer, Dunford, & Akin, 2009). In this essence, UAE education policy reform aims to build, develop and support the capacity of teachers to focus on positive education that enhances students' learning competencies through reducing the competition between schools of the Emirates and promoting effective long-term collaboration (Warner, 2018). Thus, the prudent leadership of the UAE focused on the innovation and highlighted its fundamental role in enhancing UAE economic progress. UAE government explained that producing new valuable ideas to the society as well as new services that enhance the overall quality of people's life is the core of innovation that should be emphasized in school curricula (UAE government, 2015). That is why, professional development summits about the importance of STEM and its applications are actively provided to teachers in order to facilitate better learning opportunities to their students. The objective is to showcase their STEM outcomes during science fairs and festivals as well as science competitions and conferences about innovation and entrepreneurship (Gokulan, 2018). Hence, the development of STEM curriculum is considered a step forward towards restructuring STEM education. Eltanahy (2018) recommended establishing a unified STEM policy to close the gap between STEM implementation in private and public schools in the UAE. In this essence, Eltanahy et al. (2020) developed a pulley system of interdisciplinary E-STEM learning that integrates science inquiry, technical literacy, mathematical thinking, engineering design and entrepreneurial practices from five main disciplines. Thus, it is important to involve teachers and listen to their perceptions and understand their experiences for effective development or reform because they are responsible for delivering the curriculum to students (Meryem & Sabri, 2009).

Considerable discussion has been found in the literature regarding the ability to teach entrepreneurship, however, the debate was closed by a consensus of agreement on the possibility of teaching and learning its features (Henry, Hill, & Leitch, 2005). Thus, most recently, however, the new debate has focused on the most appropriate methodology of teaching entrepreneurship to each grade level, which results in a call for a re-evaluation of the current pedagogy to emphasize teaching through an approach that works on students' abilities (Jackson, Scott, & Schwagler, 2015). The diversity of the approaches used across the world to apply entrepreneurial programs does not cause a conflict because they include business basic and focus on entrepreneurial thinking and competencies such as problem solving and opportunity recognition (Neck & Greene, 2011).

The STEM literature introduces a wide range of pedagogical approaches including strategies, models and frameworks that are used to apply STEM in the classroom. Three main approaches (silo, embedded and integrated) are currently being applied to teach STEM in schools. The degree of STEM content used is the measurement of the distinction between these methods. First: silo STEM approach refers to isolated instruction that gives more focus to knowledge acquisition and depth of understanding of each subject through a teacher-driven classroom (Dugger, 2010). Second: embedded STEM instruction emphasizes the acquisition of knowledge through problem solving of different real-life contexts (Chen, 2001). However, it might lead to fragmented learning because if students do not have prior knowledge regarding the embedded course content, the teacher has to cover the missing knowledge separately (Hmelo & Narayanan, 1995). Third: the integrated approach where all course contents from different subjects are taught as one subject (Breiner, Harkness, Johnson, & Koehler, 2012). Moreover, specific standards from each subject matter that have been incorporated with the STEM implementation to solve a real-life problem should be assessed and evaluated in an experiential learning environment (Sanders, 2009).

4. Methodology

A mixed method approach was conducted through exploratory sequential design, both qualitative and quantitative data were collected consecutively to fulfill the research questions (Creswell, 2014). The study started by collecting the qualitative data through semi-structured interviews in two focus group sittings with 12 STEM leaders and curriculum coordinators who implement STEM projects in different American curriculum schools in Dubai and Sharjah. Snowball sampling technique was utilized successfully to recruit as many STEM leaders as possible to participate in the current study. The 12 participants' real names will not be revealed; letters (A, B, C…L) will be used to refer to their responses.

The second phase of the inquiry seeks to collect quantitative data by distributing a questionnaire to Science, Technology, Mathematics and Business teachers in the same two Emirates to investigate their perceptions regarding the expected challenges that might face them during applying E-STEM projects in their classes.

- **Interview**

The interview protocol consists of three main questions that aim to explore STEM leaders' beliefs regarding how the existing STEM course they implement in schools could be restructured to accommodate entrepreneurial learning. The discussion focused on the best pedagogy and educational strategies that enhance incorporating E-STEM subjects. Moreover, challenges of this incorporation were also highlighted. The duration of each meeting lasted for about 90 minutes. The interview protocol was reviewed by an expert in the university to enhance the content reliability of the questions. The qualitative data was analyzed by coding and recoding to answer the first study question. The Ethical considerations were approached by discussing the purpose and significance of this inquiry and signing the consent form (Creswell, 2014).

- **Questionnaire**

The developed questionnaire consists of two main sections. Demographics of participating teachers were collected in the first section, while the second section was designed to investigate the expecting challenges of E-STEM implementation with 8 different elements mentioned by STEM leaders during the interview. A 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = maybe, 2 = disagree and 1 = strongly disagree) was used to measure their responses. 134 eligible responses were received from STEM teachers. The percentages and frequency of all items were calculated in a descriptive analysis. Forty-two teachers of science, technology and mathematics were recruited conveniently to participate in the pilot study. Cronbach's Alpha was calculated 0.809 via SPSS to indicate high reliability and internal consistency of all items.

5. Findings and Discussion

Data collected from STEM leaders was analyzed and interpreted to make meaning from their beliefs about the phenomenon under investigation. Their quotes were embedded in the following sections to support this interpretation.

5.1. Qualitative Results of STEM Leaders

The interview protocol consists of three main questions to explore leaders' beliefs regarding how existing STEM course could be restructured to accommodate entrepreneurial practices in the UAE. Thus, three main themes were identified and discussed in the following sections;

5.1.1. E-STEM Best Pedagogies

A majority of the STEM Leaders (10 out of 12) expressed the opinion that entrepreneurial practices could be integrated into existing STEM curriculum and disciplines which is consistent with the pully system developed by (Eltanahy et al., 2020) who suggested applying interdisciplinary approach that integrates relevant knowledge from the five main disciplines including scientific inquiry, mathematical thinking, technical applications, engineering designs and entrepreneurial practices. For example, STEM Leader

A said, “Entrepreneurial practices can be purposefully aligned with the content and practices of the four STEM subjects to provide students with a new E-STEM learning opportunity”. Participant B agreed with participant A that “E-STEM integration is applicable in any skill-based curriculum where independent learning is developed at the same time as knowledge is acquired”. Many leaders A, B, D, F, H, J, K and L expressed their positive beliefs toward the perception of participant C regarding this integration saying, “students have already conducted many inessential STEM projects, yet it could have been better and more valuable if they ware aware of E-STEM learning”.

On the other hand, (2 out of 12) leaders were not fully convinced at the beginning, as participant D clarified his doubts saying “this might be confusing for teachers because each of them will apply a different model. It needs a well-structured plan and clear model to be followed and to avoid teachers' misconceptions”. However, during the interview, less convinced peers like participants D and E agreed more with E-STEM and became more interested to contribute to the discussion saying “I agree with my colleagues on the value of E-STEM to improve actual STEM courses, but it should not be through lectures. The main focus should be given to enhancing students' profile of entrepreneurial competencies through developing their knowledge and skills in an interesting learning environment that allow them take some risks using their STEM designs and promote positive entrepreneurial attitude”. Participant F added that high school students are not close to the market and “this makes it difficult for teachers to focus deeply on the content of entrepreneurship”. Therefore, participant A suggested that “business teachers should contribute with other STEM teachers to integrate value creation practices during STEM activities”. Consequently, participant G elaborated saying “positive engagement of STEM students in the entrepreneurial-STEM activities will help them focus on the importance of their designs to the market.” In line with participant G, participant H argued that this incorporation could be successfully applied through “PjBL and PBL that develop students' skills in an experiential learning environment.” It was also emphasized that “all E-STEM activities that integrate both STEM and entrepreneurial practices should be designed through competency-based approach that allow students to investigate and learn from their mistakes.” These results from STEM leaders in American curriculum schools are aligned with findings of Eltanahy et al. (2020). The discussion with the experienced STEM leaders was rich of ideas and suggestions for the best possible approach and strategies that could guide educators concerning STEM reform to successfully incorporate entrepreneurial practices into current STEM course curricula applied in high school.

Fig. 1 demonstrates the interdisciplinary E-STEM model that was developed in light of STEM leaders' beliefs regarding incorporating entrepreneurial practices into STEM education. The model refers to the main pulleys of each subject in the

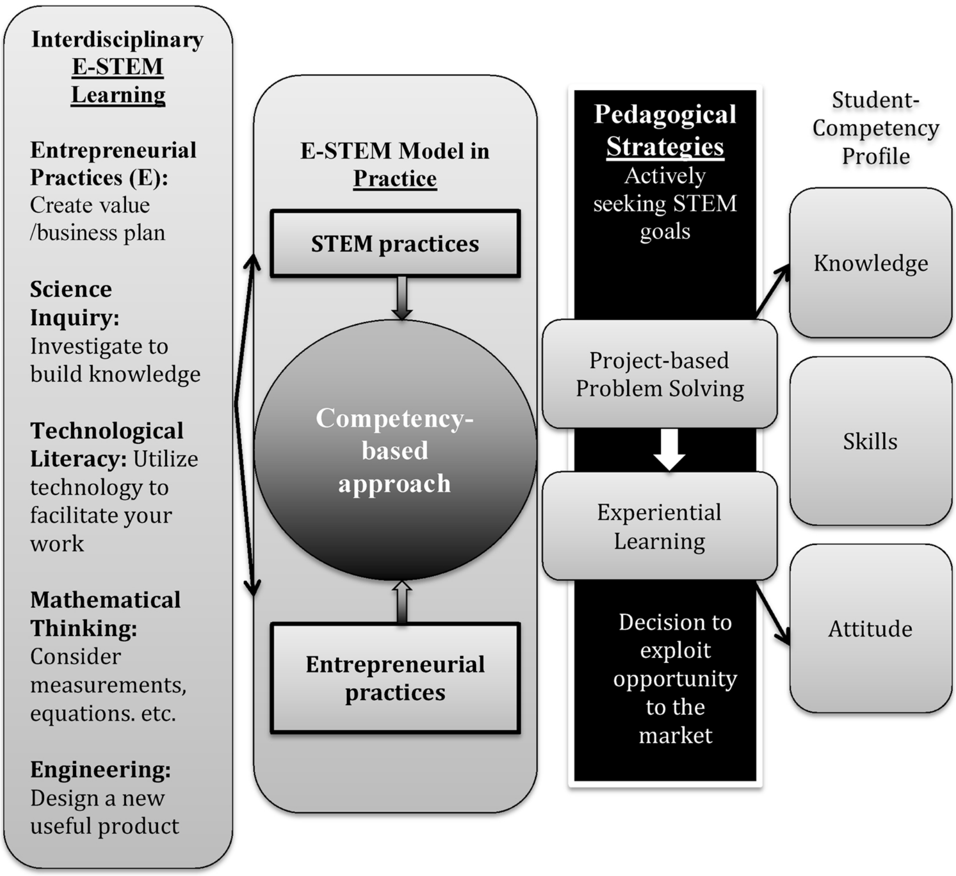

Fig. 1. Interdisciplinary E-STEM Model.

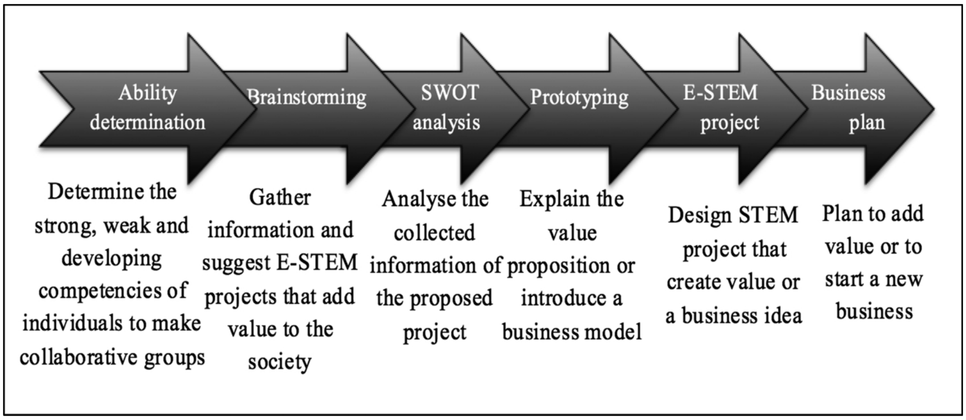

Fig. 2. E-STEM Strategic Plan.

interdisciplinary E-STEM learning, the learning approach used to incorporate entrepreneurial practices into integrated STEM education, and the pedagogical strategies derived from experiential learning to enhance students' entrepreneurial knowledge, skills and attitude. Moreover, this E-STEM model is supported by a theoretical underpinning of the study where interdisciplinary theory (Jacobs, 1989) emphasized integrating knowledge from different disciplines, social constructivist theory (Vygotsky, 1987) advocates constructing knowledge and developing competencies in a social learning environment. Additionally, education-through entrepreneurship (Johannisson, 2010) adopted a pedagogy-oriented perspective that is more appropriate for high school students to act entrepreneurially.

5.1.2. E-STEM Strategic Plan

Participating leaders suggested different practices and activities to be embedded in the STEM course applied in their schools to enhance E-STEM learning in an experiential learning environment. Accordingly, data collected from them was used to design a clear strategic plan presented in Fig. 2 in order to guide teachers to apply E-STEM projects in their classes to enhance students' entrepreneurial act. Firstly, participant, J emphasized the need for ability determination of each group of students where "a set of entrepreneurial competencies should be introduced to STEM students" in order to "determine their personal abilities to create collaborative groups to work on E-STEM projects". Participants I and K highlighted the necessity of the brainstorming stage where "each group suggests some ideas of E-STEM projects and should discuss the need and the value of each idea to select the best E-STEM project for implementation." Accordingly, participants C, H and D discussed how students should identify the available and necessary resources to achieve the proposed E-STEM project through "SWOT analysis to be aware of the strengths, weaknesses, opportunities and threats that they are expecting to face during the implementation." Participant L supported the argument of how crucial it is to convince audiences with the value of each E-STEM project through "school conferences or prototyping presentations to discuss the value of their E-STEM ideas and seek for constructive feedback from attendees before implementation." Consequently, participants F, G and E discussed the importance of E-STEM learning opportunities to enhance students' abilities to "develop, modify and design their E-STEM models that create value for others. "lastly, with the help of business teachers, STEM students in high school should be trained to design their business plans" in order to "develop more cognitive competencies that emphasize the entrepreneurial knowledge, such as product functionality, insight into the market, and financial awareness." E-STEM strategic plan will provide high school students with real-world scenarios to develop and apply entrepreneurial competencies to address its dilemma. This is consistent with the argument of Sanders (2009) that standards from different subjects should be carefully incorporated to solve real-life problems in an experiential learning environment.

5.1.3. -E-STEM Challenges

STEM leaders identified many obstacles that might decelerate the process of applying the anticipated changes in the STEM course pedagogy to incorporate entrepreneurial practices into STEM classes. They all strongly agreed on "the lack of information and training of teachers about entrepreneurial learning", as well as "the readiness of the students to start thinking beyond school walls and thinking of their future." They argued that "STEM students in the UAE can change ideas and integrated knowledge to potential products, but simply they focus only on applying this knowledge to achieve the given task, rather than creating new valuable STEM products." More critically, "some STEM teachers focus intensively on making models"; however, learning outcomes can be models, projects, ideas or even social services, so it is not only projects." Their responses indicated that "although, STEM teachers will face difficulty to assess entrepreneurial practices," adding values to the community is much more appreciated than making new designs without using them. This is consistent with Wilson (2008) who explained that diffusing entrepreneurial activities to all students of different streams is a real challenge that requires interdisciplinary approach to raise students' awareness of entrepreneurship and to develop their abilities. However, "lack of motivation is a serious issue because most of the local students are from wealthy families and they are not interested in facing difficulties," Additionally, "STEM subject teachers are overwhelmed by the heavy load of the curriculum and classes, which is a clear obstacle of any further implementation."

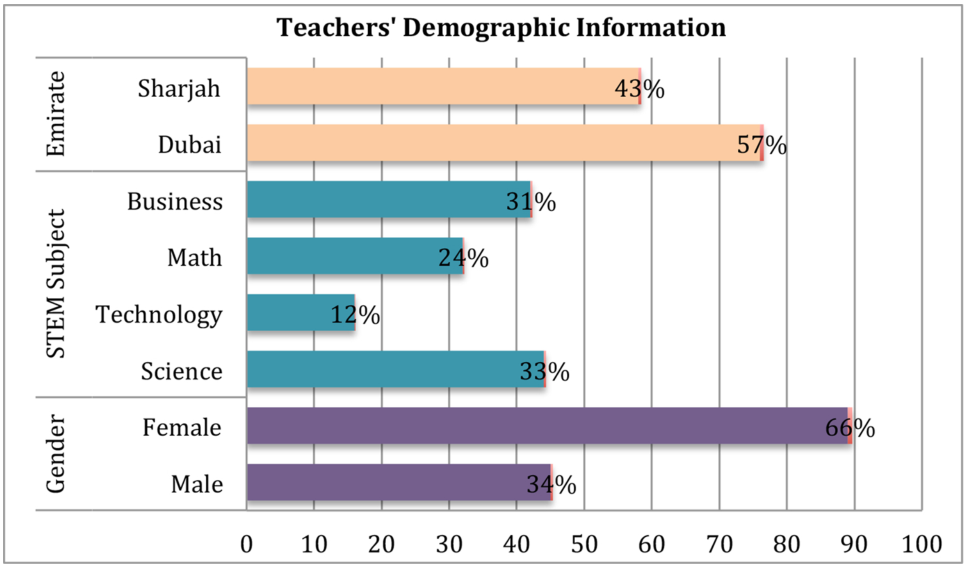

Fig. 3. Demographic Information of Participating Teachers.

More doubts were discussed regarding the incorporation of E-STEM subjects such as "STEM teachers in UAE have just started to be familiar with the STEM practices and they still struggle in the implementation and not all of them master the required skills." Clearly, they admitted that E-STEM project "is not an easy task because such a new implementation requires not only an academic support to prepare the STEM teachers, but also a development of the STEM curriculum to effectively incorporate entrepreneurial learning and that would take a long time and a huge effort to be done successfully." Furthermore, "companies do not accept to cooperate with educators easily, although they have social responsibility regarding youth." More importantly, "such an incorporation requires a budget and different resources that need approvals from the administration." Another common challenge was observed and emphasized by participating leaders as they usually suffer from, "the competition between teachers about which discipline should take more weight in the project. Unfortunately, teachers focus on the show itself more than the outcomes of STEM work."

5.2. Quantitative Results of the STEM Teacher Questionnaire

The two main sections of the questionnaire were analyzed descriptively. The percentages of teachers' demographic information were presented in Fig. 3. Whereas, both the mean and standard deviation of the challenges that might eliminate incorporating entrepreneurial practices into STEM education were presented in a descending order in Table 1.

5.2.1. Section 1: Demographic Information of Participating Teachers

Fig. 3 demonstrates the three main demographic information collected from the participating teachers that include subject specialty, the emirate they work in and gender. The geographic location of recruited teachers were Dubai and Sharjah with percentages (57% - 43%) respectively. Majority of responses received from (science 33%) and (Business 31%) followed by less participation from (math 24%) and then (technology 12%) who work for American curriculum schools. The contribution of female teachers (66%) outperform males (34%).

Table 1
Descending Rate of Challenges of Incorporating Entrepreneurial Practices into STEM Education.

Expecting Challenges	Descriptive Analysis of Responses	
E-STEM Challenges	M	SD
Lack of teachers' knowledge about entrepreneurial practices	4.56	.510
Entrepreneurial practices are difficult to assess	4.44	.547
Time limitations	4.42	.546
Lack of administrative support	3.29	.907
Lack of materials, resources and funding	3.22	1.005
Lack of innovative products: students' projects are regular and not required in the market	3.18	.939
Entrepreneurial practices do not meet my students' interests	2.69	.917
Entrepreneurial practices do not fit in the STEM curriculum used	2.57	1.114

5.2.2. Section 2: Rate of Challenges that can Prevent Incorporating Entrepreneurial Practices in STEM Education

Table 1 shows the descending order of the mean responses regarding the expecting challenges of incorporating entrepreneurial practices into STEM education. Results revealed that the lack of teachers' knowledge about entrepreneurial practices, the difficulty of assessing these practices and the limited time provided for implementation are the most significant challenges that face teachers with means (4.56, 4.44 and 4.42) respectively. In second place, another three obstacles are shown (lack of administrative support, lack of materials and lack of innovative products) with means (3.29, 3.22 and 3.18) respectively. Finally, the least significant challenges that might face teachers are entrepreneurial practices do (not meet students' interest and not fit in the STEM curriculum used) with means (2.69 and 2.57) respectively. Moreover, two values of standard deviations are much higher than the mean scores, which indicate that the data set of these two obstacles (lack of materials, entrepreneurial practices do not fit the STEM curriculum) is not normally distributed and their range of distribution is large.

Results collected from STEM leaders and teachers reflected the urgent need of support from the school administration to teachers to be able to implement E-STEM practices more effectively. Professional development programs are highly required to enhance entrepreneurial knowledge of STEM teachers. This result also indicates the importance of reducing the curriculum load that focuses mainly on academic subject knowledge to provide teachers with enough space to implement the new competencies-based model.

6. Implication

Results of the current study recommend useful practical, professional as well as research implications to enhance E-STEM learning in high schools. With respect to the practical implication, the results interpreted from the qualitative data collected from STEM leaders have shown strong evidence that restructuring STEM education to infuse entrepreneurial learning into its application is possible through applying E-STEM model and the proposed strategic plan to effectively integrate entrepreneurial practices with current STEM course curricula. In practice, interdisciplinary approach of E-STEM model requires a proper mix of both STEM practices and entrepreneurial practices via competency-based approach to focus more intensively on students' acquisition of entrepreneurial practices in an experiential learning environment. A clear strategic plan was presented in light of leaders' suggested activities that best enhance E-STEM best application. Thus, project-based problem solving is the best pedagogical strategy to actively seek STEM goals and support students to decide to exploit opportunities to the market. School leaders should enhance the communication process and partnership with companies to gradually close the gaps between learning outcomes and society needs in order to produce new generation of students who are equipped enough with competencies needed for future careers. Hence, there is constant need to reflect critically on the responsiveness of high school STEM curriculum and its relevance to students' needs and abilities. Current STEM curriculum design should be reviewed by curriculum developers and review teams using curriculum mapping and tools to embed the new E-STEM model into high school class practices. This requires involving business teachers in E-STEM learning to work collaboratively with their peers to align relevant standards from the five proposed disciplines to provide students with more meaningful learning opportunities. Furthermore, policy makers should make use of such results to support STEM education reform through developing the content and material of STEM courses.

With respect to the professional implication of E-STEM model, the implementation of the proposed model required constructivist teaching and learning practices that target entrepreneurial competencies including knowledge, skills and attitude. Teachers admitted the difficulty of entrepreneurial practices as well as the assessment of its outcomes. Moreover, there is a lack of knowledge among STEM teachers regarding entrepreneurial knowledge and its implementation. This indicates the urgent need for teachers' professional development programs regarding how to integrate entrepreneurial learning with their STEM practices to achieve this important goal.

Regarding the research implication, results of the current study open new agenda for future research concerning STEM reform and students' competency development. It is important to consider the best pedagogical framework of E-STEM for further studies to provide more clarity in the description of E-STEM meaning, purpose and process. Examination to what extent high school students are interested and motivated to learn E-STEM is also required. Considerably, future studies are recommended to explore E-STEM outcomes produced by high school students through implementing the propsed E-STEM model. In addition to investigate the impact of E-STEM implementation in enhancing students 'entrepreneurial competencies. More research should also investigate the extent to which school admin members are willing to overcome E-STEM challenges to facilitate the learning process. In addition to how experienced and talented teachers are able to utilize E-STEM available resources to address obstacles in their classes.

7. Conclusion

Incorporating entrepreneurial practices into existing STEM courses implemented in the UAE is applicable through integrating practices from both entrepreneurship and STEM education in an experiential learning environment. Competency-based approach is emphasized to adopt the interdisciplinary E-STEM model in high school because it provides students with meaningful learning opportunities to develop their entrepreneurial competencies. The study recommended a clear strategic plan of E-STEM learning consists of six activities including ability determination of students, brainstorming sessions, SWOT analysis of the proposed E-STEM ideas, prototyping, E-STEM design and finally a business plan to introduce this new E-STEM product to the available market. Thus, this strategic plan aims to launch STEM students in the direction of adding values to the society. The study also highlighted the main challenges that might face educators during E-STEM implementation. Lack of teachers' knowledge about entrepreneurial learning as well as ways to assess its practices is a big challenge that should be addressed by offering them consistent PDPs to enhance their E-STEM instruction. Although existing STEM courses or projects can be restructured to become more business-like, further support is needed from school administrations to provide teachers with enough time and resources for E-STEM practices. The current study contributed to the body of knowledge by developing the E-STEM model as an initiative that aims to capture the current interdisciplinary teaching practices to motivate students to think entrepreneurially through integrating value creation practices that promote students' competencies to act entrepreneurially.

CRediT authorship contribution statement

Marwa Eltanahy: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Sufian Forawi:** Supervision. **Nasser Mansour:** Validation, Writing - review & editing.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.tsc.2020.100697.

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