

## The Effect of a Training Program Based on STEAM Applications in Developing the Teaching Practices of Saudi English Language Teachers

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**Abstract:** The present research aimed at assessing the effect of a training program based on STEAM (Science, Technology, Engineering, Art, and Mathematics) applications on the development of the teaching practices of English language teachers in Saudi secondary schools. The sample consisted of 28 Saudi female English language teachers at the secondary schools in Jeddah city. The research followed a one-group quasi-experimental design. The material of the research was the training program, and the instruments were a pre-posttest and an observation checklist that were prepared by the researcher. The results indicated that there were statistically significant differences between the mean scores of English-language secondary school teachers in the pre- and post-tests in favor of the post-test. The results obtained from the observation checklist reinforced the results of the test and showed high scores in teachers' adoption of the STEAM applications by the end of the program. The research recommended the adaptation of STEAM applications in the teaching of different language aspects and skills.

**Key words:** Training program, STEAM Applications, English Language Teaching skills

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### أثر برنامج تدريبي قائم على تطبيقات (ستيم) STEAM في تنمية مهارات التدريس لدى معلمات اللغة الإنجليزية بالمملكة العربية السعودية

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**ملخص:** تهدف الدراسة الحالية إلى معرفة أثر برنامج تدريبي قائم على تطبيقات ستيم (العلوم، التقنية، الهندسة، الأدب، الرياضيات) في تنمية مهارات التدريس لدى معلمات اللغة الإنجليزية في المدارس الثانوية بالمملكة العربية السعودية. وقد تكونت العينة من 28 معلمة من معلمات اللغة الإنجليزية بالمرحلة الثانوية في مدينة جدة. واتبعت الباحثة المنهج التجريبي ذا التصميم شبه التجريبي للمجموعة الواحدة باختبار قبلي وبعدي. وتكونت مواد البحث من برنامج تدريبي قائم على تطبيقات ستيم، بينما تكونت الأدوات من اختبار تحصيلي قبلي وبعدي وبطاقة ملاحظة من إعداد الباحثة. وقد تم التأكد من معرفة المعلمات بتطبيقات ستيم وتبني هذه التطبيقات الواردة في البرنامج من خلال ملاحظة مدى تطبيقهن لها في التدريس في نهاية البرنامج. وأظهرت النتائج وجود فروق ذات دلالة إحصائية بين متوسطات أداء المعلمات في الاختبار القبلي والاختبار البعدي لصالح التطبيق البعدي. كما أظهرت نتائج بطاقة الملاحظة قدرة المعلمات على استخدام التطبيقات التي وردت في البرنامج التدريبي في نهاية البرنامج. وأوصت الباحثة بتبني تطبيقات ستيم في تدريس مهارات ومكونات اللغة الأخرى.

**كلمات مفتاحية:** برنامج تدريبي، تطبيقات (ستيم) STEAM، مهارات تدريس اللغة الإنجليزية



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## Introduction

English language learning and teaching (ELLT) is encountering fast and flexible changes. It is being modified continuously to cope with students' needs and requirements, society, and the labor market. The objectives of ELT have changed and are directed toward the building of the whole student: physically, emotionally, and psychologically. The objectives of learning English are to be able to listen, speak, read, and write. Moreover, it has been revised to encompass being able to read critically and to write persuasively, to listen attentively and to communicate successfully, and to exchange one's beliefs and opinions with the people around. Learning English has become a matter of building the student as a human who has many responsibilities toward oneself, the community, the environment, and consequently the whole universe. Accordingly, the teacher's role has changed into guiding, directing, and managing students' learning in the classroom, either individually or in groups, to fulfill the requirements of the new era. STEAM is an integrated approach that connects the five principles into one teaching technique to create a life-like situation in the classroom and therefore requires a well-trained teacher who is able to apply this approach effectively. The teachers, consequently, are required to adopt these new approaches, methods, and techniques to help students learn significantly. They need to develop their skills continuously to follow the recent teaching methods and approaches. Not only during their studies, that is, before starting their profession as teachers, but also during their career. They need continuous training to achieve professional development and success in their jobs. Bautista and Ortiga-Ruiz (2015) affirmed that the mission of today's teachers is not just to teach academic subjects in isolated or artificial situations but to help learners communicate effectively and use the language in real life, not only in the classroom. Training programs play a vital role in training teachers and providing them with the required skills that align with the recent needs of students and successful communication. It is believed that training programs play an essential role in successful education reform. Omar (2014, p. 1) emphasized that "the training program, such as in-service training, should not run away from the reformation that occurs". Training programs are important in developing and equipping the teaching

field with the recent reforms in the profession. Teachers need to be aware of the latest concepts and reforms in the field so they can transfer these changes to their students benefit and teaching practices. Omar (2014, p. 2) added that training programs "can enhance the professionalism of teachers who can contribute to the organization to achieve its goals and can improve their efficiency, ability, knowledge, and motivation in their professional work". TALIS (2009, p. 49) indicated that in-service training can be accomplished via "external expertise in the form of courses, workshops, or formal qualification programs, through collaboration between schools or teachers across schools or within the schools in which teachers work". This suggests that training workshops or programs can be adopted to develop teachers' skills and keep them updated with the latest changes and reforms in the field.

## The Problem

Teacher training programs are becoming a highly demanding process in a continuously developing field like teaching in his/her classroom, the teacher needs to make decisions, develop knowledge and skills, and provide the students with the possible knowledge and skills to help them learn. This suggests that teachers need to be informed of all the methods and techniques to help them develop students' learning. This will not be accomplished in a systematic and professional method except through the adoption of scientific and updated training programs. Boudersa (2016, p. 10) suggests that "the absence of training, or poor training, will make the teacher face the challenge of having poor subject knowledge and poor professional and pedagogical skills to teach a given subject, deliver the lesson, assess learning, and provide the learner with the appropriate knowledge and learning experience". The researcher applied an exploratory study by asking some English language teachers at the secondary stage about their background knowledge on one of the recent teaching approaches: the STEAM approach and its applications. They responded negatively and added that they were ready to learn and practice using it in their English language classes. The present study is a response to research recommendations (TALIS, 2009; Omar, 2014; Bautista & Ortiga-Ruiz, 2015; Boudersa, 2016) about the importance of adopting training programs for the

professional development of teachers and to teachers' requests and needs, as proved by the interview, for scientific training in STEAM applications. It aimed at preparing and training the Saudi English language teachers in the secondary schools to adopt the STEAM applications in their classrooms and measuring the effect of that training on their knowledge and actual practices.

### Questions of the Study

The present study intends to answer the following questions:

1. What is the training program based on STEAM applications required for training the English language teachers to use STEAM applications in their classes?
2. What is the effect of the proposed training program on developing the English language teachers' teaching knowledge of the STEAM approach?
3. What is the effect of the proposed training program on developing the English language teachers' teaching skills?

### Objectives of the Study

1. Preparing a training program based on STEAM applications for the Saudi English language teachers in the secondary schools.
2. Explaining the meaning and the conceptual framework of STEAM applications in ELT classes.
3. Training the Saudi English language teachers in the secondary schools in adopting the STEAM applications in their classrooms.
4. Assessing the effect of the training program in developing teachers' knowledge and actual practices of the STEAM approach.

### Significance of the study

1. Teachers of English in Saudi schools in general and secondary schools in particular will benefit from the training program in developing their knowledge and teaching practices in the English language classrooms.
2. Curriculum designers may benefit from the training program by designing activities based on STEAM applications to develop English language teaching.
3. English language supervisors may benefit from

the content of the training program in guiding English language teachers to develop their English language teaching practices in the classroom.

4. English language learners will benefit from the STEAM applications by improving their communication skills and language mastery.

### Delimitations of the Study

1. The STEAM approach applications were limited to applications that could be adopted in English language classes.
2. The sample was limited to English language teachers at the secondary level.
  1. The time of application was at the first semester of the year 2020.

## Literature Review

### The Context of STEAM Education

The first use of the acronym STEM to mean Science, Technology, Engineering, and Mathematics, is attributed to the National Science Foundation (NSF) in 1998, when it was used to denote their teacher education program STEMTEC (Sireci, Zanetti, Cadman, Salter, & Berger, 2001), while the letter (A) was added later to denote Art. Jr (2016, p. 6) emphasized the insertion of the subject Art by saying "a focus on STEM subjects in education alone will not meet the needs of our students or our nation. Science, technology, engineering, and math education require the arts at the center of learning as well". Jr (2016) confirmed that the infusion of Art into STEM education helps make learning situations similar to authentic situations with an emphasis on expressive thinking via symbolic languages. Taylor (2016), in addition, discussed the importance of integrating the Art with STEM education to prepare learners with "higher abilities" for the 21st century challenges and for the requirements of the labor market, in which mastering a foreign language has a very important role. It is important to recognize that the content taught in STEM subjects is not separable from the language through which the content is presented (Schleppegrell, 2007). "There is no language-free content; language use always presents some content, and most representations of content require some language use, even with multimodal resources for meaning-making" (Francis & Stephens, 2018, p. 58). Francis & Stephens (2018, p. 59) added that "shaping

contexts to enable students to expand their linguistic repertoires is an important goal of instruction in all subjects and in STEAM subjects as well". However, there is no agreement on the definition of the term STEAM. Struyf, De Loof, Pauw and Petegem (2019, p. 9) underlined the role of 'constructivist learning theory' and explained how learning in this theory constitutes an active process of knowledge construction where learners construct meaning for themselves based on prior knowledge. Learners can use their prior knowledge of science, math, engineering, and technology, along with their knowledge of language vocabulary and structure, to form new knowledge and experiences.

Colucci-Gray, Burnard, Cooke, Davies, and Trowsdale (2016, p. 6) assumed that STEAM education may refer to 'language in use,' paying attention to how stakeholders discuss STEAM 'within discourse' and 'within a set of social and contextual relationships.' According to Yakman (2008, p. 1), STEAM is "a developing educational model of how traditional academic subjects can be structured into a framework by which to plan integrative curricula." Yakman (2008) added that using STEAM education requires the integration of all subjects as they appear in real life. He also advised teachers to provide comprehensive coverage of their areas of expertise, for example, science, while reinforcing what students are learning in other areas, like English language skills. Moreover, Boy (2019) asserted the value of a holistic design of learning where connectivity, communication, and interaction are the most important attributes that should dominate over classes. Disciplines cannot be taught in isolation, but they should exemplify real society by introducing the four subjects STEM integrated with 'A' for 'Art' in order to make learning real and vital. "STEAM English language learners (ELs) develop STEM knowledge and language proficiency when they are engaged in meaningful interaction in the classroom" (Francis & Stephens, 2018, p. 2). English language teachers must understand that "language is learned through meaningful and active engagement by ELs with language in the context of authentic STEM activities and practices" (Francis & Stephens, 2018, p. 3). Although the STEAM approach has proven vital for inclusive learning, targeted learning will not be achieved without the use of appropriate vocabulary and correct structure. The curriculum should direct

teachers to "engage students in developing a range of important scientific concepts and inquiry skills". Language as part of Art (humanities, language arts, and fine arts) plays an important role in the development of learners' vocabulary and structure, allowing them to select and use appropriate language to express their knowledge and thoughts. The integration of the 'A' referring to Arts into STEM suggested that the four main subjects—science, Technology, Engineering and mathematics—cannot be separated from literary skills' and 'strong writing abilities.' The four subjects cannot be explained or understood clearly without the use of suitable vocabulary and appropriate structure. Language as an art is strongly recommended to express the feelings and thoughts of the speaker while talking about other subjects, as it really appears in actual life. Francis & Stephens (2018, p. 129) concluded that "STEM subjects afford opportunities for ELs to simultaneously learn disciplinary content and develop language proficiency through engaging in STEM disciplinary practices".

### **Teachers' Training Programs**

The twenty-first century has provided a new foundation for holistic, student-centered education, which necessitates a teacher who believes in students' abilities, diverse interests, and attitudes and who encourages students' innovation and cooperation. The classroom environment should be motivating, supportive, and inspiring to give students the chance to learn with confidence and autonomy. The classroom is becoming a student-centered classroom where the student is active, learning individually and autonomously, cooperating, and exchanging information in a realistic interactive environment. The role of the teacher has changed as well; s/he is no longer the source of information who is dominating and controlling every activity; the teacher is now the mentor and the facilitator of learning. These new roles call for continuous professional development to equip the teacher with the skills and knowledge required to fulfill this new, dynamic role. Professional development, which is well known as in-service training and "offers one of the most promising roads to the improvement of instruction," is very important as it helps to "equip the teachers with new knowledge and skills to face new challenges and reformation in education" (Omar, 2014, p. 2). Iddings (2005), Verplaetse (2000) and Yoon (2008)

explained that classroom interactions depend largely on the teacher's effort to promote ELs academic success and participation. Bunch (2013) added that teachers must create opportunities for the development of language learning through the adopted teaching method and the practiced activities.

New approaches and teaching strategies are continuously developed to fulfill the requirements of current trends in language teaching. Boy (2019, p. 1) emphasized that systems need to be investigated and tested as wholes, which requires a cross-disciplinary approach and new conceptual principles and tools, and that schools cannot continue to teach isolated disciplines based on simple reductionism. The STEAM approach is one of the new approaches that can help teachers achieve the objectives of English language teaching.

Saxton, Burns, Holvek, Kelley, Prince, Rigelman and Skinner (2013) developed a tool to measure STEAM education and found that the measure should include teacher's professional development, students' learning, and school-level variables. They recommended that teacher's professional development should not be limited to the remote memorization of STEAM content but should go beyond that to cover higher-order thinking skills. They also emphasized the importance of teachers' practice in STEAM applications. Paul (in Iakovos, 2011) stressed the importance of teacher's use of cooperative learning as often as possible, which can be inevitably achieved via good adoption of STEAM education.

Teachers need to practice their new roles and implement educational reforms to raise the standard of teaching and improve their students' participation. English language teachers are among other teachers who should have continuous practice and be informed of the recent approaches and practices in language teaching inside and outside the classroom. The need for in-service training is becoming of vital importance in education to "enhance the professionalism of teachers who can contribute to the organization to achieve its goals". Training programs are the medium through which the organization can develop, inspire, and provide its employees with the recent requisites and skills needed to "enable them to carry out their responsibilities to the required standard in the present job and to undertake greater and more demanding roles for effective job performance" (Omar, 2014, pp. 1-2).

These training programs are as important in education as they are in other sectors. It is not an exaggeration to say that training programs are the only trusted and recent method to keep teachers informed with the latest knowledge and skills in their field.

#### **Teachers' Development and STEAM Education**

Science, Technology, Engineering, Arts, and Mathematics (STEAM) education is one of the learning approaches that focuses on connecting the five subjects and creating real-life learning environments that bring real life into the classroom. Teachers are the main factor that can facilitate and create these situations. "Teachers are crucial to creating classroom environments that can leverage the assets that ELs bring to STEM learning" (Francis & Stephens, 2018, p. 89). STEAM language teaching needs a teacher who can lead classroom activities and guide students toward achieving STEAM objectives. However, teachers need professional training that inspires them to use STEAM applications in their classes; they need to develop both disciplinary concepts and practices along with knowledge about the language related to the disciplines, which calls for extra training and practices (Saxton et al., 2013).

Snow and Brinton (1997) stated that teachers of STEAM require additional education around using and facilitating disciplinary discourse and that this can be integrated into their content area instruction, as it is now widely accepted that language development and content learning are interrelated. Francis & Stephens (2018) stressed that teachers must engage in training programs that help equip teachers and teacher candidates with tools and preparation to position ELs in STEAM content learning. These programs should not be limited to theoretical knowledge and scientific concepts but should go further to cover real-life practices and applications. Boy (2019, p. 1) explained that "education in the twenty-first century should bring back this necessary capacity of knowing how, when, and what to do to perform the ideal function in a given situation, including communicating the right information to the right person at the right time". Madden, Baxtera, Beauchampa, Boucharda, Habermasa, Huffa, Ladda, Pearona, and Plaguea (2013) mentioned that the success of any program, including STEAM, requires that teachers be interested, enthusiastic, engaged in professional development and reflection to design creativity, and be able to promote

students' autonomy and self-learning. Colucci-Gray et al. (2016) explained that research should be directed toward helping teachers develop their experiments and their "dynamic engagement with partners in STEAM practices". They concluded that teachers should organize school days for STEM education using creative, inquiry-based, and critical pedagogies.

Francis & Stephens (2018, p. 6) stated that "teacher education programs should provide courses that include learning research-based practices on how to best support ELs in learning STEAM subjects". Seggara, Natalizio, Falkenberg, Pulford and Holmes (2018) illustrated that STEAM strategies complement traditional pedagogy and training approaches, allowing trainees to exercise creativity and innovative thinking. They stressed that schools should strive to use STEAM approaches to foster the creativity of instruction and instructors in training. In spite of the recommendations about the possibility of training teachers and the possibility of using STEAM applications in the English language classroom, some researchers have doubted the success and practicality of adopting STEAM applications in the teaching of other subjects, like English language classes. They reinforced that there are not enough qualified educators with expertise in any of the three STEM domains of science, mathematics, and technology. Goldhaber, Krieg, Theobald, and Brown (2015, p. 28) found that "individual secondary teachers, however, would not be able to develop the expertise required in all the STEM subject areas to enable an individual teacher to provide an integrated approach." Burrows and Slater (2015, p. 6) proposed a progressive education in which teachers progress from Level Zero (single discipline) to Level Four (multiple disciplines) (constant STEAM education) and added that there is still a testable trajectory between these two levels. Sanchez and Cortes (2019, p. 5) declared that there are two main challenges facing teachers when implementing STEAM education in their classes: an integrative approach (different subjects' content must be applied simultaneously) and multidisciplinary education (teachers have to teach content outside their comfort area or specialty).

## **Methodology**

### **Research Context, Procedures and Participants**

The present study was conducted under the supervision of the Educational Training Administration (ETA). It is the

authorized body for teachers' training and development; it has the facilities and authority to nominate and invite teachers to participate in the training program. The research was implemented on February 25, 2020, and the experiment lasted for 3 days and 5 hours daily. The total number of training hours was 15. The teachers were personally trained by the researcher during the three days to ensure that the training program was implemented accurately.

The research followed the experimental method with a quasi-experimental design. This design depends on using the independent variable, the training program based on STEAM applications, in developing the dependent variable, which is the teaching practices of English language teachers at the secondary school. The design was a one-group pretest-posttest design where the dependent variable was measured once before the treatment was implemented and again after the treatment. This design was selected because it is the most appropriate design for the objectives of the study, as it is intended to measure teachers' practices and ability to use STEAM applications by testing their knowledge before and after the program and then by observing their actual application by the end of the program.

The participants were 28 English language teachers working at the Saudi Public Secondary Schools in Jeddah City. The teachers were pre-tested about the STEAM approach and its application in the ELT classes before the application of the training program. Then the training sessions started by informing teachers about the STEAM approach and how it is adopted in ELT classes.

The training program was divided into three sessions, and each session lasted for five hours. The first session covers the theoretical background of the program and describes the conceptual framework of the STEAM approach. The second session is the practical part, and it concentrates on presenting processes and models of ELT classes that are adopting the STEAM approach in ELT. The third session, however, covers the application of ELTs when adopting the STEAM approach in ELT classes. After completion of the training program, the teachers were given a post-test with the same test questions to evaluate their knowledge and practices about the application of the STEAM approach in ELT classes and to assess the effect of the training program in improving their knowledge. The third session covers the teachers' actual practices, as they were asked to present their own lessons while applying the STEAM applications in front of their peers.

The population of the research included all the English language teachers at the secondary schools in Saudi Arabia's Jeddah City. The teachers were selected randomly from the secondary schools in Jeddah city and asked to join the training program at the residence of the ETA. The number of participants was 28 female teachers who teach English in secondary schools.

**Instrumentation**

- A. The research material consists of the training program that was prepared by the researcher and lasted for three days of training, with five hours per day. (See Appendices 1 & 1A)
- B. As for instrumentation,
- C. The researcher adopted the following two instruments:
- D. a pre-posttest examining the effect of the training program by determining whether there were any significant differences in the means of the teachers' test responses regarding STEAM application in English language classes before and after the training program, and an observation checklist that was used by the researcher to assess teachers' actual application of the STEAM approach strategies and techniques during their English language classes. The

test consists of 10 fill-in-the-gap questions assessing teachers' knowledge about the STEAM acronym reference, the change in teaching objectives and techniques based on the training program that is based on the STEAM approach, the objectives of learning English, and the roles of learners and teachers. The number of gaps in the test is 25, and each gap is given 1 mark for the correct answer and 0 for the wrong one, so the total mark of the test is 25. The validity and reliability of the test were estimated via the following procedures:

- E. Face Validity: The test was given to reviewers who are specialized in education and English language teaching to express their views on the validity of the questions and to determine their levels, to indicate the accuracy of their formulation and linguistic integrity, and the clarity of their meanings. The researcher made some modifications according to the reviewers' suggestions for the development of the test.
- F. Internal Consistency: The test's internal consistency was confirmed by applying it to a group of teachers other than the research sample. After data collection, the Pearson correlation coefficient was used to find out the validity of the internal consistency of the test (see Table 1)

**Table 1.**  
**Pearson Correlation Factors and its Significance for the Test**

Item	Correlation Factor	Item	Correlation Factor
1	0.636**	6	0.511*
2	0.676**	7	0.648**
3	0.565*	8	0.661**
4	0.676**	9	0.548*
5	0.521*	10	0.549*
*Significant at 0.05		**Significant at 0.01	

Table 1 shows that the correlation coefficients between the expressions and the total score of the test items were all significant at a significance level less than .05.

**Reliability:** The reliability of the test was confirmed by using the half-split method, which reached 0.811,

which was a good and acceptable reliability percentage for the purposes of scientific research.

**Difficulty Factor:** The difficulty factor was estimated using the following equation:

The total score obtained on the question.  
Number of participants x question score

**Table 2.**  
**Difficulty Factor of Test Questions**

Question	No. Participants	Total Score of the question	Total grades of the question	Difficulty Factor
1	28	97	140	69.2%
2	28	32	56	57.1%
3	28	33	28	58.9%
4	28	19	28	67.8%
5	28	97	168	57.7%
6	28	40	56	71.4%
7	28	31	56	55.3%
8	28	29	56	51.7%
9	28	43	84	51.1%
10	28	18	28	64.2%

The results of Table 2 indicate that the degrees of difficulty for the test range between 51.1% and 71.4%, and this indicates an appropriate difficulty of the test questions. (See Appendix 2).

An observation checklist (prepared by the researcher) to check the actual practices of the sample in the English language classes. The researcher observed the participants herself to guarantee the correct application and appropriate use of the checklist. The participants were asked to teach varied lessons to their peers to make sure they comprehended the approach and its applications and could apply them in their actual classes. The observation checklist consisted of 15 items describing the main applications that should be practiced when teaching English using the STEAM approach in English language classes. The items on the checklist were given one mark if the teacher applied the technique and zero if she did not. The total score of the checklist was 15, and the validity and reliability of the observation checklist were estimated via the following procedures:

**Face Validity:** It was estimated by giving the checklist to reviewers who are specialized in education and English language teaching to express their views on the validity of the items and to determine their relation to the STEAM approach applications, their formulation and linguistic integrity, and the clarity of their meanings. The researcher made some modifications according to the reviewers' suggestions for the development of the checklist.

**Reliability:** It was calculated by administering the checklist to a group of teachers with the help of another observer (an experienced supervisor) who was trained to use the checklist. The researcher and the supervisor observed the same teacher's teaching performance at the same time. The reliability of the observation checklist was calculated according to the following equation:  $R = \frac{\text{times of agreement}}{\text{times of agreement} + \text{times of disagreement}} * 100$ . The results showed that the reliability of the observation checklist reached 82.75%, which was an acceptable level of reliability. (See Appendix 3)



## Findings

1. To answer the first question: What is the training program based on STEAM applications required for training the English language teachers to use STEAM applications in their classes? The researcher prepared a three-day training program that is composed of the following:
2. The trainer package, which consists of the detailed training program components such as a theoretical background about STEAM, the general goal of the program, specific learning outcomes, the title of the program, targeted group, duration time, dimensions of the program, materials and instruments, methods, strategies, and evaluation,
3. The trainee package consists of a summary of the training program and all the detailed components of the training program. The Power-Point presentation and the instruments that are used in the training of teachers. It also consists of a description of the STEAM approach and all the practical applications of the program. The two packages were evaluated by specialists in ELT. They added simple comments and modifications, which were adopted by the researcher.
4. The three days of the training program were implemented as follows: The first day covered the conceptual framework of the STEAM approach; the second day concentrated on processes and models of classes adopting the STEAM approach in ELT; and the third day focused on practical applications of ELT classes adopting the STEAM approach. The application of the training program took place on February 25, 2020, and lasted for three days of five hours each. Each day of the training program was divided into two sessions, and each session lasted for two hours and a half. The researcher performed the training herself and started by introducing herself to the trainees and getting acquainted with everyone in the session. The training was implemented by describing the main goal of the program and the expected learning outcomes. The pre-test was adopted on the sample before starting

the program to check the trainees' background knowledge about the STEAM approach and its applications in ELT classes. The training program was carried out starting with a theoretical framework about the STEAM approach in ELT. Then, it discussed the role of STEAM applications in English language teaching classes. The second day concentrated on describing the processes and models of ELT classes adopting the STEAM approach. The researcher implemented this session by showing real classes and YouTube videos that showed the actual applications of STEAM classes. During the session, the trainees were asked about the processes and procedures the teachers usually apply in STEAM classes. The discussion covered the main characteristics of the class and the techniques adopted to explain different language aspects: the meaning of new vocabulary, grammatical structures, a reading lesson, a listening or speaking lesson, or a writing lesson. The session lasted for five hours, and it concentrated on analyzing and evaluating ELT classes that are adopting the STEAM approach. The third day focused on applications of ELT classes adopting the STEAM approach, and these classes were implemented by the teacher trainees themselves, teaching their peers. During the teaching of the trainees, the researcher used the actual observation using the checklist to assess the trainees' application of the STEAM approach in the ELT, check the effect of the training program on the teachers' classroom practices, and answer the research questions. (See appendix 1)

To answer the second question, what is the effect of the proposed training program on developing the English language teachers' teaching knowledge of the STEAM approach? and to determine the effect of the proposed training program on developing teachers' knowledge of STEAM applications in ELT classes. The mean scores of secondary school English language teachers on the pre and posttest were calculated using the T-test to see if there was any significant difference between the means of the pre and posttest. Then, the eta square equation was used to estimate the level of effect of the training program, and Table 3 shows these results.

**Table 3.**  
**The results of the *t*-test between the pre and the post tests**

Test	N	M	SD	T Value	Sig. Level	Eta Square	Effect Size
Pretest	28	12.78	2.743	24.69	0.000	.891	High
Posttest	28	22.82	1.740				

To answer the third question, what is the effect of the proposed training program on developing the English language teachers' teaching practices? To check the actual performance of the teacher trainees of what they practiced on the first and second days, teachers were asked to perform actual classes and teach their peers so they would be able to practice what they had learned in the training program and benefit from their peers' feedback and suggestions. At the same time, the researcher observed the trainees' classes and evaluated their performance using the observation checklist. The results of the checklist confirmed the results of the trainees' achievement in the posttest because the teachers achieved high grades in the observation by adopting most of the STEAM applications while they were teaching on the third day. Furthermore, the teachers were remarkably creative and innovative in their applications, which emphasized the high effect of the training program.

**Discussion**

The results of the present research are compatible with the results of several previous studies that stressed the importance of professional development or in-service training in developing the knowledge and skills of teachers (Omar, 2014; Dagli, 2013; Yakman, 2008). The results also reinforced the recommendation of some research that emphasized the importance and possibility of developing English language teachers' skills in using STEAM applications in English language classes via training programs or workshops like the study of Francis and Stephen (2018). Snow and Brinton (1997) also supported these results by stating that STEAM teachers need more training on how to use and facilitate disciplinary discourse, as well as how to integrate it into their content area instruction, because it is now widely accepted that language development

and content learning are interrelated.

Boy (2019, p. 1) commented that "education of the twenty-first century should bring back this necessary capacity of knowing how, when, and what to do to perform the ideal function in a given situation, including communicating the right information to the right person at the right time," which can be accomplished through continuing practice via workshops and training programs.

Finally, Colucci-Gray et al. (2016, p. 68) explained that research should be directed toward helping teachers develop their experiments and their "dynamic engagement with partners in STEAM practices". They stated that teachers should organize school days for STEM education using creative, inquiry-based, and critical pedagogies, which were practiced in the present research through the training program. Seggara, Natalizio, Falkenberg, Pulford and Holmes (2018) also supported the results of the present research by stating that schools should strive to use STEAM approaches to foster the creativity of instruction and instructors in training.

**Conclusion**

English language teaching is confronting an increasing need for mastering the language and being able to communicate fluently and spontaneously in an open society that is trying to cope with a knowledge explosion and unlimited communication. Continuous professional development and adaptation to recent trends in English language teaching are becoming vital requirements. The STEAM approach is one of the new approaches that aims to create learning environments that are communicating, dynamic, and relevant. The current research attempted to assess the effect of a training program based on STEAM applications on developing English-language

secondary school teachers teaching practices and the level of their interaction with STEAM applications. The researcher prepared a training program that aims at training English language teachers to adopt STEAM applications in the teaching of English at a secondary school in Saudi Arabia. The results of the study showed a high effect of the training program and a significant difference between the means in the performance of the teachers in the pre- and post-test in favor of the post-test. The results of the observation checklist emphasized the results of the t test and suggested that the program has a positive effect on developing the teachers' performance and that they are able to adopt the STEAM approach in English language classes and can be creative and original.

The current study agrees with previously applied studies (e.g., Taylor, 2016; Seggara, et al., 2018) which stressed the importance of STEAM education in increasing creativity of both teachers and students. Other research studies stressed the importance of STEAM education in integrating subjects purposefully and to present them equally and side by side as they appear in reality (Yakman, 2008. Colucci-Gray, et al., 2016. Madden, et al., 2013). Taylor suggested that more practice and more workshops or training programs should be offered for teachers in other school levels and other subjects to encourage the adoption of STEAM applications in the classroom. Teachers should be encouraged to concentrate on the relationships between different disciplines and to be creative to connect subjects in a harmonious design.

The research recommended that many studies are needed to adopt STEAM applications in the teaching of different language aspects and skills in order to develop students' communication, interest, and motivation to learn the language in an integrated approach as it is actually used in reality. Training programs that aim to develop teachers' skills and classroom practices about recent teaching approaches and methods are also recommended to keep teachers updated with new trends in English language teaching.

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