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The Effect of STEM Practices on Teaching Speaking Skills in Language Lessons

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Abstract

In language teaching, speaking is one of the complex skills that need to be developed specifically. However, how to teach speaking skills is an ongoing debate. The aim of this study is to examine the effect of STEM-based activities on the development of speaking skills of students in secondary schools. The study was conducted in a secondary school in Uralsk, Kazakhstan in 2022. In the study designed according to the control group pretest-posttest design, STEM activities in the experimental group and traditional teaching practices in the control group were carried out. The pretest-posttest and experimental application of the study was carried out with 60 students, 30 experimental and 30 control groups. As a result of the 6-week experimental applications, it was found that STEM-based activities in the experimental group increased students' speaking skills compared to traditional teaching. In addition, as a result of the experimental applications, it was observed that STEM-based activities increased students' attitudes towards language lessons and speaking skills at a positive and high level.

Introduction

Human language is considered the most powerful tool to mediate people's connections with the world. Language education is a learning style in which many factors such as cognitive skills, readiness level, cultural and social characteristics, desire to learn, mastery of the mother tongue and environment are effective (Boroujeni & Fard, 2013; Şengül & Sünbül, 2015). The application and integration of technologies in many areas of education is gaining popularity (Banihashem et al., 2022; Noroozi et al., 2012, 2018, 2021). Thanks to the use of the Internet and the World Wide Web, new learning opportunities arise. In this way, teaching and learning styles develop and change is required to adapt to these new practices. Today, mobile technologies, which are active in almost all areas of life and become widespread in education, have become an indispensable tool to mediate the learning of language learners. Mobile technologies that touch the lives and times of learners cannot be ignored (Kukulska-Hulme, 2012). The use of information technologies in language education has become more prominent as an effect of the rapid change in educational technology. The Web offers a wide variety of resources for both teachers and students to search for and access original materials. When these approaches and methods are applied to language

learning, it is difficult for researchers to ignore mobile technologies that have recently played an increasingly important role in second language learning. In parallel with the developments in the technological field, many developments have occurred in the field of educational technologies. Language teaching is also included in the areas where educational technologies are frequently used. When compared with traditional teaching methods and techniques, it is known that the use of technological course materials in foreign language teaching has an important place in terms of permanent knowledge, lesson motivation and versatile development. Mother tongue teaching methods are also constantly changing and developing in parallel with scientific and technological advances (Isisag, 2012; Kessler, 2018; Shyamlee & Phil, 2012).

Language includes four basic skills under the titles of comprehension (reading, listening) and expression (writing, speaking). One of the aims of mother tongue education courses is to provide students with the ability to express their thoughts and feelings orally in accordance with the rules of language, accurately and effectively. Speaking, which is one of the skills based on expression, is the transfer of feelings, thoughts and information to others through language consisting of sounds after they are designed in the mind (Balcı & Sünbül, 2015; Hedge, 2000). Speech, which has a decisive role in an individual's communication and interaction with other people in daily life, is also a reflection of mental development, personality formation and social relations (Scrivener, 2005). Despite this, speaking, which is one of the four basic skills, is one of the skills we use the most, but it is the least emphasized skill in education (Elkhair, Oradee, 2012). McDonough, Shaw, and Masuhara (2013) stated that speaking is generally seen as less valuable than other skills. How to teach speaking is an ongoing debate (Richards 1990). In the development of productive language skills (speaking and writing), the skills are expected to be realized in practice. In order to measure these skills and to determine the status based on these measurements, the performance of the individual in the context of the given task should be taken as a basis for evaluation. In this context, the evaluation of a performance level related to speaking requires the description of each sub-dimension of the relevant skill separately and a rating in which different performance levels can be determined. The most useful approach that fulfills these two conditions for a complete assessment is performance-based assessment. In performance-based assessment, rating scales (analytic scales, holistic scales and observation forms) are frequently used (Cheng & Fox, 2017; Mertler, 2016).

Traditional speaking approaches and methods were practiced in our world for about seventy years between 1900 and 1980. In the following years, these approaches and methods were harshly criticized and various inadequacies were listed. Some of these criticisms include the fact that they emphasize mechanical processes rather than the mind in speech teaching, that repetition, memorization and imitation studies are intensive, that they develop memorization rather than mental processes in speech, and that they do not respond to the real communication needs of students. These criticisms led to the abandonment of traditional methods in the 1980s (Vergnaud, 2008). Later, the Audio-Visual Method was created by adding a visual dimension to the listen-speech method. This method is based on using sounds and pictures together. In addition, elements such as gestures, facial expressions, excitement and emotional body language were also utilized (Rodríguez Seara, 2004). The audiovisual method aims to teach skills in the areas of listening, speaking, reading and writing. For this purpose, priority is given to oral language, followed by written language. At the same time, elements such as expression of emotions and excitement and body language are also included. In the teaching process, emphasis was placed on sound and

image, ear and eye (Rodríguez Seara, 2004; Puren, 2004). Therefore, we can say that STEM-based teaching is a continuation of the Audiovisual Method.

It is emphasized in many studies that speaking instruction should be carried out in very rich communication environments (Gan, 2012). Regarding how speaking instruction can be handled in a practical way, Katchen (2004) considered it as an environment that facilitates the demonstration of audiovisual role models with the support of instructional technologies and stated that using rich communication forms as role models will facilitate the teaching of presentation skills. Magasic (2017) mentions that multidirectional communication environments in language teaching reflect positively on student performance and that there are four main benefits of using visual and verbal interactive tools for students. These are authentic language, oral language, translanguaging features (gestures, facial expressions, body language, etc.) and motivational benefits. One of the most important elements of language learning is the methods used by the teacher to carry out language learning processes successfully. The use of technology, especially information and communication technologies, offers serious opportunities for language teaching. As in many areas of education, the use of technology naturally affects the change in the methods and processes of language teaching (Ahmadi, 2018; Pourhossein Gilakjani & Sabouri, 2017). It is thought that STEM-based speaking skill teaching will make significant contributions to language teaching in this context. Today, technological developments have brought many innovations, not only making life easier for human beings, but also revolutionizing their lives. One of these innovations is virtual reality. It can be seen in recent studies that the use of STEM in language teaching saves time, provides motivation and efficiency, and is more economically feasible, and stands out as a useful tool in these respects. It is known that the adaptation of advanced technological tools with new constructive learning activities i.e. peer learning is crucial (see Latifi et al., 2020, 2021a, 2021b; 2021c; Noroozi, 2018, 2022; Noroozi et al., 2016, 2018). It is important to increase and improve the efforts made to realize this adaptation and the advanced technological tools and equipment used in the name of education. Technological tools are needed more in language teaching than in other branches of social sciences. There is a need to create sounds and images that will appeal to the speakers of the language to be taught and to use them as course materials. The continuity of the search for language learning also necessitates the use of technological tools in this field (Peregoy & Boyle, 2012). As in every field of education, the use of technology in language teaching is becoming preferable. The fact that technology, which has the quality to meet the need for materials in the process of acquiring the four basic language skills, appeals to many senses provides convenience in language teaching.

STEM is an abbreviation consisting of the initials of the words Science, Technology, Engineering, Mathematics. STEM education is an educational approach that involves teaching science and mathematics by integrating them with the application possibilities provided by technology and engineering based on science and mathematics and covers all levels from pre-school to higher education (Gonen & Korkmaz, 2022; Landicho, 2020; Ozkan, 2022; Razi & Zhou, 2022). The basis of STEM education is to bring real life problems to the educational environment and to offer various solutions (Aydogan & Koc, 2022; Breiner, Harkness, Johnson & Koehler, 2012; Hebebci & Maya Hebebci, 2021; Hebebci, 2021; Hebebci, 2022; Kaban, 2021; Serhan & Almeqdadi, 2021;). STEM is an interdisciplinary approach and provides an opportunity for students to learn these concepts and skills more meaningfully by integrating concepts and skills from different STEM fields and applying them to a real-life

problem or event (Altakhyneh & Abumusa, 2020; Baterna, Mina & Rogayan, 2020; Capraro, & Capraro, 2014; Wilson et al., 2022; Yang & Baldwin, 2022). It is stated by Wang (2012) that the curriculum model that should be used and even created for the effective realization of STEM education is the integrated or integrated curriculum model (Bybee, 2013), and accordingly, it is suitable for the integrated curriculum structure as a whole is created by eliminating the clear lines between STEM education and disciplines. Many studies have shown that STEM education provides individuals with skills such as creativity, critical thinking and problem solving, and increases academic achievement and retention of what is learned (Hartzler, 2000; Judson & Sawada, 2000; Köngül & Yıldırım, 2021; Olivarez, 2012; Song, Shin, & Lee, 2010). At the same time, it was determined that students were more willing to learn by improving their attitudes towards the course positively. In this context, it is argued that the use of STEM approach in lessons will increase students' creativity and self-confidence by doing, experiencing, exploring, and discovering (Luo, Wang, Liu, & Zhou, 2019; Mills, 2013; Sung & Na, 2012; Venville et al., 2000). The STEM education approach is accepted in the world of education because it enables students to develop 21st century skills such as collaboration, communication/people management, critical thinking, problem solving, creativity (Kärkkäinen & Vincent Lancrin, 2013; Katehi et al., 2009) as well as providing students with the opportunity to gain the knowledge and skills of four fields at the same time. In addition to providing students with skills, STEM education removes the boundaries between these disciplines by enabling students to understand the world as a whole rather than parts with a learning-teaching approach that integrates different disciplines (Lantz, 2009). STEM education communities around the world have been endorsing integrated STEM education for more than two decades (Sanders, 2012). In this direction, projects and academic studies are carried out for the implementation of integrated STEM education in schools. STEM education enables students to bring solutions to problems by applying the theoretical knowledge they receive (Bybee, 2010; Nong et al., 2022). The combination of many disciplines that are related in themselves for a common purpose enables the individual to realize holistic and meaningful learning by establishing a connection between the knowledge learned and the experiential knowledge acquired in daily life. Through STEM learning experiences, students are prepared for the global economy of the 21st century (Becker & Park, 2011). The concept of STEM education emerged from the need for citizens who will contribute to their country economically and scientifically in the new information age we live in (Baterna, Mina & Rogayan, 2020; Capraro, & Capraro, 2014). STEM education is an approach that aims to teach the four disciplines mentioned above as an integrated whole and covers all educational processes from pre-school to higher education (Bybee, 2010). During childhood and adolescence, individuals are curious and eager to explore the world around them and are active learners, creators and inquirers just like scientists (Katz, 2010). It is therefore important to provide them with the resources and opportunities to explore, investigate and develop their innate abilities, but traditional formal education can limit their interests and negatively affect their attitudes towards learning (OECD, 2006). The rote-based curricula and multiple-choice central exams in Turkey add to this negativity. STEM education aims to enable students to design and develop solutions to problems that interest them by using their mathematical, scientific and technological knowledge acquired through problem-based learning and scientific inquiry methods (Sanders, 2009; Juškevičienė, Stupurienė & Jevsikova, 2021).

Key elements that contribute to effective STEM education include coherent, aligned, well-designed high-standard educational curricula, high-capacity and well-trained teachers, supportive assessments (testing) and accountability, appropriate instructional time, and equitable access to quality STEM learning opportunities

(Morrison, 2006; Rodríguez-Nieto & Alsina, 2022; Turebayeva et al., 2020). Research also emphasizes the above-mentioned elements for effective school education. In addition to these elements, education enhancers such as strong leadership, professional collaboration among teachers, strong ties with parents and the community, a student-centered learning environment, and instructional guidance for teachers can be added. These elements have been shown to support learning gains even in schools with students experiencing extreme poverty and hardship (Akdeniz et al., 2016; NRC, 2011).

The correlation between language teaching and the STEM approach is an undeniable fact for some of the reasons we emphasized at the beginning of our study. It should not be forgotten that language teaching can be opened to the masses only through this integration, even if it is characterized as "rentable". However, although all new approaches and technologies used in language teaching from past to present have brought a new dynamism to the field and created an industry in this field, they have always remained in the shadow of the same theory in terms of learning/teaching technique. As long as the search for language teaching continues, the use of technological inventions in this field will always be in question (Cheon, 2019; Kim et al., 2022; Tytarenko et al., 2021). In fact, the use of technology in the classroom has always been a focus for language teachers and researchers. Various methods have been developed to individualize teaching, some of which have been accepted and some of which have been rejected. One of the systems developed as a result of efforts to individualize teaching is the STEM approach, which is one of the methods developed to increase the effectiveness of teaching processes in education programs. The most important difference of STEM education is that it makes mathematics, science, engineering, art and design an integral part of the education model in addition to language education. In this context, in this study, mathematics, science, art and design education are considered as an integral part of a holistic language education in teaching mother tongue speaking skills (Lin, 2022; Marín-Marín et al., 2022; Su et al., 2022).
Tytarenko et al. (2021) practiced the STEM framework to English education and ran an experiment involving students. The students were divided into two groups, one group taught normally and the other with the new framework. To verify that the application of STEM in English is useful, this study referenced Griese et al.'s (2015), Nong et al's (2022) and Sun et al's (2021) questionnaires and designed a STEM learning perceptions questionnaire. It provides numerous different ways of analyzing students' concentration, organizational capacity, and peer interaction when using the STEM English education system. Over the course of half a term, it was clear that students taught under the STEM system yielded better results, improving more than the other group in all four aspects of the English language. Makoe and Shandu (2018) designed an application for English that makes use of a "daily usage" feature that motivates users to come back every day, making it a habit in the process. As the world moves toward an era of digital entertainment, video games are now more abundant than ever, including educational video games. Chen et al. (2018) even took it a step further and implemented STEM and AR gaming into education, captivating children and motivating them to learn.

There are two different approaches to how to integrate technology use with language learning processes. According to the first approach, the cognitive approach, students can shape their knowledge repertoire by making their interactions with language more intense and meaningful. According to the social approach, which represents the second view, students should be provided with quality social interaction and collaboration opportunities to develop real life skills (Andriani, Yuniar, Abdullah, 2021 Tomlinson, 2001; Warschauer, 2000). When we look

at the literature on this issue, we cannot come across a study on the use of STEM applications in teaching Kazakh as a language. Therefore, in the present study, an examination of the adaptation of STEM-based applications to Kazakh language teaching will be carried out and the use of advanced technological tools and equipment in language teaching, especially in teaching Kazakh as a mother tongue, will be emphasized. When the literature is examined, while there are studies on language education in which the effects of a single method on grammar level, language achievement or attitude towards language learning are determined, there is no innovative and comprehensive study on the development of students' speaking skills in mother tongue at the secondary school level. In this respect, it is thought that the results obtained in this study will contribute to the elimination of this deficiency in the field. In this context, the study examined the effects of STEM-based teaching method on middle school students' speaking skills and attitudes towards language lessons. In line with this purpose, answers to the following questions were sought in the study.

- Is there a significant difference between the mean posttest speaking skills scores of the students in the experimental group with STEM activities and the control group with traditional instruction?
- Is there a significant difference between the mean posttest attitude scores of the students in the experimental group with STEM activities and the control group with traditional instruction towards language lessons?

Method

In this study, a quasi-experimental research design with pretest-posttest control group was used because quantitative data were to be obtained from existing groups. Quasi-experimental research is a method in which we can examine the effect of the independent variable on the dependent variable because it involves manipulation, and the internal validity of the quasi-experimental research design is higher than the full experimental research design (Nind, 2020). The dependent variable in the study is students' speaking skills scores and their attitudes towards the language course. The independent variable is the use of STEM-based teaching method in teaching speaking skills. In the study, the existing classrooms in the school were used and no effort was made to equalize the groups. It was randomly determined which group would be the experimental group and which group would be the control group. A scale form consisting of 25 questions prepared to cover "speaking skills" teaching was applied to the experimental and control groups at the same time. With the attitude scale, it was tried to determine their thoughts towards the language course. The lessons were planned and taught by the researcher. In the experimental group, speaking skills were taught using STEM-based method. The control group was not intervened and was taught with traditional methods. The graphical representation of the experimental model used in the study is summarized in Table 1:

Table 1. The Experimental Process between the Experimental and Control Groups

Groups	Pretest	Experimental Process	Posttest
G1	$T1_{,12}$	STEM Activities 6 Weeks	$T2_{,12}$
C	$T1_{,12}$	Traditional Teaching 6 Weeks	$T2_{,12}$

In the study, T1, 12 represents pre-tests, T2, 12 represents post-tests, G1 represents the experimental group in which STEM activities were applied, and C represents the control group.

The study group of the research consists of 2 branch-groups of students in a secondary school in Uralsk in the 2022 academic year. The study group was determined using convenient sampling method, which is one of the non-random sampling methods. Considering the distribution of the study group according to gender and groups, there were 15 girls and 15 boys in the experimental group and 15 girls and 15 boys in the control group. The pretest speaking skills and attitude scores of the students in the experimental and control groups before the experimental applications of the research are shown in Table 2 and Table 3.

Experimental Procedure

The study lasted six weeks in total. In order for each student to participate fully in the study, students were tried to attend all classes. The technological tools used in the lesson were checked before each lesson and measures were taken to prevent any technological problems. In the study, the 6-week acquisitions in the Kazakh Language Lesson Teaching Program were completed in both the control and experimental groups within the time period deemed appropriate in the program. At the beginning of the study, the attitude scale towards speaking skills and language lessons was applied to the experimental and control groups simultaneously as a pre-test.

In the experimental group, two class hours were devoted to speaking-listening activities every day of the week. STEM method was applied for six weeks without a break. In the 1st week, sample activities from the field of science, the first dimension of STEM, were performed on the sample text in the textbook. In the second week, students performed speaking activities in the technology dimension of STEM with sample online videos and computer-assisted instruction applications. At this stage, it was tried to make students feel how much technology has a place in speech and language skills. It was conveyed to the students that the number of electronic products has increased and that these products bring some problems as well as benefits. In the 3rd week of the experimental application, students in the experimental group performed speaking skill activities in the engineering dimension within the scope of STEM method. At this stage, the students designed and planned the texts and contents of the speeches they were going to deliver and carried out group and individual presentation activities in the classroom. In the fourth week of the experimental practices, students tried to express their speech texts in the mathematics dimension of STEM with formulation and numbers. In the last two weeks of the experimental interventions, students prepared speech content by actively using all STEM dimensions and presented it in the classroom environment. Throughout this process, the control group was routinely taught the current program with the traditional teaching-by-presentation approach. At the end of the research applications, both groups were simultaneously administered the speaking skills and attitudes towards language courses scale as a post-test.

Data Collection Tools

In this study, the 'Speaking Skills Rating Scale' and the 'Attitude towards Language Lessons and Speaking Skills Scale' were used to collect research data. The application of the scale was carried out by the researcher by

explaining to the students in the pre-test and post-test sessions without any time limitation. Descriptive information about the measurement tools is given below.

Speaking Skill Rating Scale

In this study, a Likert-form scale was developed by the researcher to measure the speaking skills of middle school students in language lessons. The scale was adapted from the dimensions and items of the measurement tools developed by Hughes (2003) and Öztürk & Arıca-Akkök (2019) for the same purpose. The Speaking Skill Rating Scale developed in this study is designed as a tool that can be used for native Kazakh speakers to evaluate speaking performance and to provide feedback to the speaker in areas of weakness and strength that can be used in the process-dependent evaluation of speaking performance. The Speaking Skill Rating Scale consists of a total of 25 items in four subscales. Exploratory and confirmatory factor analyses revealed the validity of the 4 sub-dimensional structure. These four sub-dimensions explain approximately 61.9% of the variance of the characteristics that the Speaking Skills Scale aims to measure. The sub-dimensions of the scale are 'Discourse', 'Fluency', 'Content-language use' and 'Interaction-presentation strategies'. Since the appropriateness of the content and the level of the rating scale may vary depending on the needs of individuals and institutions, the whole 'Speaking Skill Rating Scale' or each part of it can be used separately for the purpose. On the other hand, since its content validity is ensured, it can be used as a "frame of reference" when developing other scales for the measurement of speaking skills.

Attitudes towards Language Lessons and Speaking Skills Scale

In order to collect the attitudinal data of the study, the researcher developed the 'Attitude Scale towards Language Lessons and Speaking Skills'. The scale is in Likert question form and consists of 15 questions on a 5-point scale. While scoring the items of the scale, the positive or negative attitude statements were taken into consideration; positive attitude statements were scored as 5-4-3-3-2-1 and negative statements were scored as 1-2-3-3-4-5. The highest score that students could get from the scale was determined as 5 and the lowest score was determined as 5. Before the scale was applied in the study, a plot test was conducted in an equivalent sample. In the preliminary application of the scale, its validity was tested with exploratory and confirmatory factor analysis methods and its reliability was tested with Cronbach's Alpha method. As a result of the factor analyses, it was seen that the 'Attitude Towards Language and Speaking Skills Scale' had a unidimensional structure. In addition, Cronbach Alpha reliability coefficient was found to be .94 in the internal consistency test of the unidimensional structure. These findings indicate that the 'Attitudes Towards Speaking and Language Skills Scale' has high reliability and validity to be used in this experimental study.

Data Analysis

In order to determine whether parametric analyses could be performed on the raw scores of the speaking skills and attitude scale tests obtained in the study, it was first investigated whether the data showed a normal distribution. In this direction, when the data obtained from the scales applied as pre-test and post-test were

examined, it was seen that there was no significant difference according to the Shapiro-Wilk analysis results for the pre-test and post-test scores. On the other hand, when Skewness and Kurtosis values are analyzed, it is seen that these values are between -0.02 and -1.02. According to Tabachnick and Fidell (2013), if the Skewness and Kurtosis values are between -1.5 and +1.5, and according to George and Mallery (2010), if these values are between -2 and +2, the data can be considered normally distributed. In this framework, it was determined that the data obtained within the scope of the research were normally distributed and parametric analyzes could be performed on the data. For this purpose, Independent Samples t test technique was used on the pre-test and post-test scores of the participant students according to the groups.

Findings

Table 2 shows the results of the t-test analysis between the pretest speaking skills scores of the students in the experimental and control groups. According to the results of the analysis, t values of 0.53 were calculated in the speaking dimension, 0.10 in the fluency dimension, 1.08 in the content-language use dimension, 0.36 in the interaction and presentation dimension, and finally .66 in the total speaking skills pre-test scores. According to these values, no significant difference was found between the groups in all sub-dimensions and total scores of the speaking skills scale ($p>0.05$). According to this finding, we can say that the experimental and control groups had equivalent speaking skills before the research applications.

Table 2. Comparison of the Speaking Skills Test Scores of the Students in the Experimental and Control Groups before the Training by t Test

Pre-Test	Group	N	Mean	Std. Deviation	t	p
Discourse	Experimental	30	3.33	0.48	-0.53	0.60
	Control	30	3.40	0.50		
Fluency	Experimental	30	3.67	0.47	0.10	0.92
	Control	30	3.70	0.65		
Content-use of language	Experimental	30	3.43	0.50	-1.08	0.28
	Control	30	3.60	0.67		
Interaction-presentation	Experimental	30	3.40	0.67	0.36	0.72
strategies	Control	30	3.33	0.76		
Speaking Skills Total Score	Experimental	30	3.47	0.25	-0.68	0.50
	Control	30	3.52	0.36		

Table 3 shows the results of the t-test analysis between the pretest attitude towards language skills scores of the students in the experimental and control groups. According to the results of the analysis, a t value of .89 was calculated in the pre-test scores of the two groups towards language lessons. According to this value, there was no significant difference between the groups in the pre-test scores towards language lessons ($p>0.05$). According to this finding, we can say that the attitudes of the students in the experimental and control groups towards language courses were at the same level before the research applications.

Table 4 shows the results of the t-test analysis between the posttest speaking skills scores of the students in the experimental and control groups.

Table 3. Comparison of the Attitude Scores of the Experimental and Control Group Students towards Language Lessons before the Training by t Test

Pre-Test	Group	N	Mean	Std. Deviation	t	p
Attitudes towards Language Lessons	Experimental	30	3.23	0.50	-0.89	0.38
	Control	30	3.40	0.89		

According to the results of the analysis, t values of 2.41 were calculated in the dimension of utterance, 1.84 in the dimension of fluency, 3.75 in the dimension of content-language use, 2.14 in the dimension of interaction and presentation, and finally 3.49 in the total speaking skills posttest scores. According to these values, no significant difference was found only in the fluency dimension ($p>0.05$). However, a significant difference was found in favor of the experimental group in other dimensions and total speaking skills ($p<0.05$). As a result of the experimental procedures, the students in the experimental group, in which STEM was implemented, achieved a high level of speaking skills.

Table 5 shows the results of the t-test analysis between the post-test language course attitude scores of the students in the experimental and control groups.

Table 4. Comparison of the Speaking Skills Test Scores of the Students in the Experimental and Control Groups after the Training by t Test

Post-Test	Group	N	Mean	Std. Deviation	t	p
Speech	Experimental	30	4.20	0.81	2.41	0.02
	Control	30	3.77	0.57		
Fluency	Experimental	30	4.03	0.56	1.84	0.07
	Control	30	3.77	0.57		
Content-language use	Experimental	30	4.37	0.67	3.75	0.00
	Control	30	3.73	0.64		
Interaction-presentation strategies	Experimental	30	3.93	0.91	2.14	0.04
	Control	30	3.47	0.78		
Total Speaking Skills	Experimental	30	4.1333	0.47	3.49	0.00
	Control	30	3.6833	0.53		

According to the results of the analysis, a t value of 2.71 was calculated between the posttest language skills attitude scores of the two groups. According to this value, a significant difference was found in favor of the experimental group in the post-test attitude scores of the groups towards the language course ($p<0.05$). As a result of the experimental procedures, it was seen that the students in the experimental group, in which STEM application was carried out, had high levels of positive attitudes.

Table 5. Comparison of the Attitude Scores of the Students in the Experimental and Control Groups towards Language Lessons after the Training by t Test

Post-Test	Group	N	Mean	Std. Deviation	t	p
Attitudes towards Language Lessons	Experimental	30	4.17	0.91	2.71	0.01
	Control	30	3.53	0.90		

Discussion and Conclusion

In this study, the effects of STEM and traditional teaching practices in teaching speaking skills were examined comparatively. In addition to the different methods used in speech education, the usability of the STEM approach in speech education was examined. According to the findings of the study, the students who received STEM intervention scored higher in the post-test scores of 'Discourse', 'Content-language use', 'Interaction-presentation strategies' and total speaking skills compared to their peers in the control group. However, no significant difference was found between the two groups in speaking skills in the fluency dimension. These findings are similar to the findings of the studies conducted by Assiri (2015), Dedebali (2014), Jablon (2017), Kentish (1995), McCaslin (2006), Nazara (2011). In the literature research on STEM, it was stated that the method increases creativity, problem solving, writing, communication, presentation, using technology, cognitive higher-order thinking capacity, perspective development, critical thinking, empathy skills and student motivation. In language education, providing students with an interactive and student-centered friendly teaching environment where they feel comfortable makes significant contributions to the development of speaking skills (Assiri, 2015; Nazara, 2011). In addition to science and mathematics education, which are the main areas of STEM, research supports that it is an effective teaching method in social sciences and language education (Hwang et al., 2014). In international studies, STEM, which includes many techniques such as creative drama and visualization, is useful, useful and effective in many educational programs and provides high development especially in language teaching (Jablon, 2017). With the STEM approach, the learning content that the students in the experimental group interact with within the scope of the speaking skills curriculum does not only consist of concepts, facts and simple verbal expressions. Students are confronted with a multifaceted and diverse range of stimuli related to language skills. For this reason, STEM-based strategies that include very rich stimuli, involve children's language use in their daily lives, and are effective in the realization of learning tasks have been effective in the development of students' speaking skills. According to De Bot, Lowie, and Verspoor (2006), Seitenova and Zhaksylykova (2021) the most important thing about language acquisition is that the language process is a complex interaction of many factors. When a person wants to express an idea, he or she has to find the words for that idea, put those words into a properly constructed sentence, pronounce the words in the correct order, and activate thousands of small muscles while pronouncing them. Such a complex thing can only be realized with a multifaceted interaction in a natural environment. Therefore, the rich stimulus environments, individual and group activities in STEM applications in the experimental group positively affected the students' competence in speaking skills. However, no significant difference was found between the groups in the fluency dimension of speaking skills. According to Al Hosni (2014), fluency in speaking requires long-term practical activities in and out of school. The fact that the experimental applications of the research included a short period of 6 weeks, on the other hand, activities for

fluent speaking outside the school were not planned may have been effective in this result. In addition, studies reveal that having sufficient vocabulary knowledge and speaking clearly are important for students' fluent speaking (Ur, 1996). The fact that the students did not have sufficient readiness in this regard at the beginning of the experimental applications may also be the reason for low fluency.

Another finding of this study is related to the changes in the attitudes towards language and speaking skills of the groups in which STEM and traditional teaching was applied. According to the data analysis, the students in the experimental group who were exposed to STEM activities developed high level attitudes towards language lessons in the post-test. These findings are similar to the results of the studies conducted by Jones (2009) and Lee (2014). The importance of attitudes in teaching speaking skills has been emphasized in many studies (Mihaljević Djigunović, 2006; Seitenova, 2014; Sparks & Ganschow, 1996). In this study, two of the striking results of the implementation of STEM-based activities are the positive attitudes towards speaking and language skill activities and the self-confidence developed in students in this regard. One of the most important goals of the programs implemented in the middle school period is to provide children with affective characteristics for language skills and self-expression. According to Salı (2015), it is important to get rid of negative emotions in language teaching and to plan appropriate fun activities to achieve this. According to Johnston (2005), students' affective experiences related to language, especially their proficiency beliefs and self-confidence in language skills, have a high impact on self-expression. In the study, the self-confidence that children gained through STEM activities during the process increased their behaviors such as participating more in the lesson, enjoying doing the activities, enjoying and being interested in the lesson, etc. and this situation increased their self-expression to high levels.

In addition, during the STEM activity, it was observed that students were active and a fun atmosphere was created in the classroom, students had the opportunity to listen to their friends' real and unexcited speaking skills, their self-confidence increased by making presentations, and the feeling of pride of producing a product was observed in the study practices. Jones (2009) and Lee (2014) stated that STEM and computer-assisted language teaching that employs different methods increases students' motivation, attitude and achievement. One of the most striking results of the study is that the students stated that they were more excited during the application process and made presentations with confidence after a certain preparation process. Dedebali (2014) stated in his study that multimedia applications such as STEM increased students' listening comprehension, listening skill awareness and attitudes towards listening positively and that this increase was permanent. She also stated that the opinions of the experimental group students towards multimedia activities in the development of listening skills were positive.

Based on the findings of the study, it is evaluated that it is possible to apply STEM more effectively in language education in general and in teaching speaking skills in particular. Teachers' and students' knowledge, skills and motivation to produce content through STEM environments should be developed through these environments, thus enriching the teaching activities in these environments and making them more qualified. Create environments in schools where students and language teachers can make effective use of technological and STEM opportunities in their extracurricular time. STEM offers new and important opportunities both for Kazakhstan's transformation in the field of education and for the development of language teaching as part of this transformation. In order to ensure success in teaching speaking skills by making use of these opportunities and to realize the relevant actions,

the practices in this field should be reflected in the curricula, especially teachers and students. In order to ensure success in STEM-based speaking skill teaching, studies in this field should be designed and carried out with a planned and holistic approach. In this context, the main goals, priorities and objectives of the use of STEM in teaching Kazakh language skills should be determined, and measures and tools should be defined to ensure that this process is carried out efficiently, monitored and evaluated transparently. Finally, longitudinal studies based on long-term monitoring of students' STEM-influenced speaking skills in middle school and beyond can be conducted. In addition, STEM-based language and speaking skill programs can be developed and experimental and mixed-method studies can be conducted on different study groups and variables.

References

Ahmadi, M. R. (2018). The Use of technology in English language learning: A literature review. International *Journal of Research in English Education, 2*(3), 115-125.

Akdeniz, C., Bacanlı, H., Baysen, E., Çakmak, M., Doğruer, N., Erişti, B., Eyyam, R., Gündoğdu, K., Karataş, E., Kayabaşı, Y., Kurnaz, A., Sünbül, A.M. & Tok, H. (2016). Learning and Teaching. Ankara: Cozum Eğitim Yayıncılık

Altakhyneh, B.H. & Abumusa, M. (2020). Attitudes of University Students towards STEM Approach. *International Journal of Technology in Education (IJTE), 3*(1), 39-48.

Andriani A., Yuniar V.D., & Abdullah F. (2021). Teaching English grammar in an Indonesian junior high school. *AL-ISHLAH*, 13, 1046–1056. 10.35445/alishlah.v13i2.956

Assiri, M. S. (2015). *English as a foreign or second language: Selected topics in the areas of language learning, teaching, and testing*. Partridge Publishing Singapore

Aydogan, H., & Koc, M. (2022). Junior High School Teachers' Self-Efficacy Levels for STEM Practices: A Sample of Aydin City. In P. Dankers, M. Koc, & M.L. Ciddi (Eds.), *Proceedings of ICEMST 2022--International Conference on Education in Mathematics, Science and Technology* (pp. 15-21), Antalya, TURKEY. ISTES Organization.

Balcı, Ö. & Sünbül, A. M. (2015). Students' opinions on the activities based on learning styles in English foreign language reading classes. *SDU International Journal of Educational Studies*, 2(1), 1-19.

Banihashem, S. K., Noroozi, O., van Ginkel, S., Macfadyen, L. P., & Biemans, H. J. A. (2022). A systematic review of the role of learning analytics in enhancing feedback practices in higher education. Educational Research Review, 100489. https://doi.org/10.1016/j.edurev.2022.100489.

Baterna, H.B., Mina, T.D.G., & Rogayan, D.V. (2020). Digital Literacy of STEM Senior High School Students: Basis for Enhancement Program. *International Journal of Technology in Education (IJTE), 3*(2), 105-117.

Boroujeni, S. A., & Fard, F. M. (2013). A Needs Analysis of English for Specific Purposes (ESP) Course For Adoption Of Communicative Language Teaching (A Case of Iranian First-Year Students of Educational Administration). *International Journal of Humanities and Social Science Invention, 2*(6), 35-44

Breiner, J.M., Harkness, S.S., Johnson, C.C., & Koehler, C.M. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. *School Science and Mathematics, 112*(1), 3-11.

Bybee, R. W. (2013). *The Case for STEM Education*. New York: NSTA Press

Chen, S.Y., Hung, C.Y., Chang, Y.C., Lin, Y.S., & Lai, Y. H. (2018). A study on integrating augmented reality technology and game-based learning model to improve motivation and effectiveness of learning English vocabulary. In *IEEE 1st International Cognitive Cities Conference (IC3)*, (New York, NY: IEEE;), 24–27. 10.1109/IC3.2018.00015

Cheng, L., & Fox, J. (2017). Assessment in the language classroom: Teachers supporting student learning. Palgrave.

Cheon, E.Y. (2019). English conversation system using artificial intelligent of based on virtual reality. *Journal of the Korea Convergence Society, 10*(11): 55–61. 10.15207/JKCS.2019.10.11.055.

De Bot, K., Lowie, W., & Verspoor, M. (2005). *Second language acquisition*. New York: Routledge, USA.

Dedebali, N. C. (2014). *The effect of multimedia applications on the development of 6th grade listening skills*. (PhD Thesis). Adnan Menderes University, Aydın.

Elkhair, M.I.H. (2014). Pronunciation Problems: A Case Study of English Language Students at Sudan University of Science and Technology. *English Language and Literature Studies*, 4. Canadian Center of Science and Education.

Gan, Z. (2012). Understanding L2 Speaking Problems: Implications for ESL Curriculum Development in a Teacher Training Institution in Hong Kong. *Australian Journal of Teacher Education, 37*(1), 43-59

George, D., & Mallery, M. (2010). *SPSS for Windows step by step: A simple guide and reference*. Boston: Pearson

Gonen, M., & Korkmaz, O. (2022). Do Students' STEM Skill Levels Affect Their Math and Science Achievement? International *Journal of Technology in Education (IJTE), 5*(4), 552-570. https://doi.org/10.46328/ijte.293

Griese, B., Lehmann, M., & Roesken-Winter, B. (2015). Refining questionnaire-based assessment of STEM students' learning strategies. *Int. J. STEM Educ.* 2, 12. 10.1186/s40594-015-0025-9

Hartzler, D. (2000). A *meta-analysis of studies conducted on integrated curriculum programs and their effects on student achievement (Doctoral dissertation).* Retrieved from ProQuest Dissertations and Theses (UMI No: 9967119).

Hebebci, M. T. (2022). Secondary School Students' Hopes and Goals for STEM Education. In P. Dankers, M. Koc, & M.L. Ciddi (Eds.), *Proceedings of ICEMST 2022-- International Conference on Education in Mathematics, Science and Technology* (pp. 175-180), Antalya, TURKEY. ISTES Organization.

Hebebci, M. T. & Maya Hebebci, G *Proceedings of ICSES 2021-- International Conference on Studies in Education and Social Sciences*. (2021). Evaluation of 3D Design Applications in STEM Education. In S. Jackowicz & O. T. Ozturk (Eds.), (pp. 28-39), Antalya, TURKEY. ISTES Organization.

Hebebci, M. T. (2021). Investigation of teacher opinions on STEM education. In M. Shelley, I. Chiang, & O. T. Ozturk (Eds.), *Proceedings of ICRES 2021-- International Conference on Research in Education and Science* (pp. 56-72), Antalya, TURKEY. ISTES Organization.

Hedge, T. (2000). *Teaching and Learning in the Language Classroom*. Oxford University Press.

Hughes, A. (2003). *Testing for language teachers*. Cambridge: Cambridge University Press

Hwang, W. Y., Shadiev, R., Hsu, J. L., Huang, Y. M., Hsu, G. L., & Lin, Y. C. (2016). Effects of storytelling to facilitate EFL speaking using Web-based multimedia system. *Computer Assisted Language Learning, 29*(2), 215-241.

Isisag, K. U. (2012). The positive effects of integrating ICT in foreign language teaching. Paper presented at the

International Conference Proceedings, ICT for Language Learning.

Jablon, P. (2017). Theater as the STEAM Engine for Engaging Those Previously Disengaged. In J. Bazler & M. Sickle, *Cases on STEAM Education in Practice* (pp. 118-155). Hershey, PA: Information Science Reference

Jones, R., G., (2009). Emerging Technologies Speech Tools and Technologies. *Language Learning & Technology, 13*(3), 4–11.

Judson, E., & Sawada, D. (2000). Examining the effects of a reformed junior high school science class on students' math achievement. *School Science and Mathematics, 100*(8), 419-425.

Juškevičienė A., Stupurienė G., & Jevsikova T. (2021). Computational thinking development through physical computing activities in STEAM education. *Comput. Appl. Eng. Educ*. 29, 175–190. 10.1002/cae.22365

Kaban, A. (2021). Use of learning management systems in the COVID-19 pandemic. In S. Jackowicz & I. Sahin (Eds.), *Online Education during the COVID-19 Pandemic: Issues, Benefits, Challenges, and Strategies* (pp. 81-98). ISTES Organization.

Kärkkäinen, K., & VincentLancrin, S. (2013). *Sparking Innovation in STEM Education with Technology and Collaboration*. Paris: OECD.

Katz, L. G. (2010). STEM in the early years. In *SEED (STEM in Early Education and Development) Conference*, Cedar Falls, IOWA. http://ecrp. uiuc. edu/beyond/seed/katz. html.

Kentish, B. (1995). Hypotheticals: Deepening the Understanding of Environmental Issues through Ownership of Learning. *Australian Science Teachers Journal*, 21-25.

Kessler, G. (2018). Technology and the future of language teaching. *Foreign Language Annals, 51*(1), 205-218.

Kim, J., Park, S.M., Joo, M., Park, J., Lee, Y.L., Jang, J.H., & Cardoso, W. (2022). Preliminary investigations for the development of a virtual reality-based English-language communication program: Using the Delphi method. *PLoS One, 17*(3):e0264850.

Köngül, Ö. & Yıldırım, M. (2021). Effects of STEM applications on the scientific process skills and performance of secondary school students. *Journal of Human Sciences, 18*(2), 159–184.

Kukulska-Hulme, A. (2012). Language learning defined by time and place: A framework for next generation designs. In J.E. D_ıaz-Vera (Ed.), Left to my own devices: Learner autonomy and mobile assisted language learning. Vol. 6: *Innovation and leadership in English language teaching* (pp. 1– 13). Bingley: Emerald Group.

Landicho, C.J.B. (2020). Research Attitudes, Motivations, and Challenges of STEM Education Researchers. *International Journal of Technology in Education (IJTE), 3*(1), 49-61.

Lantz, H. B. (2009). Science, technology, engineering, and mathematics (STEM) education: What form? What function? What is STEM education? https://dornsife.usc.edu/assets/sites/1/docs/jep/STEMEducationArticle.pdf

Latifi, S., & Noroozi, O. (2021a). Supporting argumentative essay writing through an online supported peer-review script. *Innovations in Education and Teaching International, 58*(5), 501–511.

Latifi, S., Noroozi, O., & Talaee, E. (2020). Worked example or scripting? Fostering students' online argumentative peer feedback, essay writing and learning. *Interactive Learning Environments*, 1–15.

Latifi, S., Noroozi, O., & Talaee, E. (2021c). Peer feedback or peer feedforward? Enhancing students' argumentative peer learning processes and outcomes. British Journal of Educational Technology, 52(2),

768–784. https://doi.org/10.1111/BJET.13054

Latifi, S., Noroozi, O., Hatami, J., & Biemans, H. J. (2021b). How does online peer feedback improve argumentative essay writing and learning? Innovations in Education and Teaching International, 58(2), 195-206. https://doi.org/10.1080/14703297.2019.1687005

Lee, L. (2014). Digital news stories: Building language learners' content knowledge and speaking skills. *Foreign Language Annals, 47*(2), 338-356

Lin, H. (2022). The Influence Mechanism of High School English Grammar Science, Technology, Engineering, Art, and Mathematics Teaching Model on High School Students' Learning Psychological Motivation. *Front Psychol. 25*(13), 917167.

Luo, T., Wang, J., Liu, X. & Zhou, J. (2019). Development and application of a scale to measure students' STEM continuing motivation. *International Journal of Science Education, 41*(14), 1885-1904.

Magasic, M. (2017). Learning through Watching: Streaming Video in L2 English. *The Jalt Call Journal, 13*(3), 199–209.

Makoe, M., & Shandu, T. (2018). Developing a mobile app for learning English vocabulary in an open distance learning context. *Int. Rev. Res. Open Distrib. Learn.,* 19, 208–221. 10.19173/irrodl.v19i4.3746

Marín-Marín, J.A., Moreno-Guerrero, A.J., Dúo-Terrón, P., & López-Belmonte, J. (2021). STEAM in education: a bibliometric analysis of performance and co-words in Web of Science. *Int J STEM Educ., 8*(1), 41.

McCaslin, N. (2006). *Creative Drama in the Classroom and Beyond*. Boston: Alyn and Bacon/ Longman Inc. Sample Chapter.

McDonough, J., Shaw, C. & Masuhara. H. (2013). *Materials and Methods in ELT: A Teacher's Guide*. Oxford: Blackwell

Mertler, C. A. (2016). *Classroom assessment: A practical guide for educators*. Routledge

Mihaljević Djigunović, J. (2006). Role of affective factors in the development of productive skills. In M. Nikolov & J. Horváth (Eds.), *UPRT 2006: Empirical studies in English applied linguistics* (pp. 9-23). Pécs: Lingua Franca Csoport.

Mills, L. A. (2013). Indicators of science, technology, engineering and math (STEM) career ınterest among middle school students in the USA [PhD Thesis]. University of North Texas.

Morrison, K. R. B. (1993). *Planning and accomplishing school-centred evaluation*. Dereham, UK: Peter Francis.

National Research Council. (2014). *STEM integration in K-12 education: Status, prospects, and an agenda for research*. National Academies Press.

Nazara, S. (2011). Students' perception on EFL speaking skill development. *Journal of English Teaching, 1*(1), 28-42.

Nind, M. (2020). A new application for the concept of pedagogical content knowledge: teaching advanced social science research methods. *Oxford Review of Education, 46*(2), 185-201. DOI: 10.1080/03054985.2019.1644996

Nong, L., Liao, C., Ye, J.H., Wei, C., Zhao, C., & Nong, W. (2022). The STEAM learning performance and sustainable inquiry behavior of college students in China. *Front Psychol*. *20*(13) 975515.

Noroozi, O. (2018). Considering students' epistemic beliefs to facilitate their argumentative discourse and attitudinal change with a digital dialogue game. *Innovations in Education and Teaching International, 55*(3), 357-365. https://doi.org/10.1080/14703297.2016.1208112

Noroozi, O. (2022). The role of students' epistemic beliefs for their argumentation performance in higher education. *Innovations in Education and Teaching International,* 1-12.

Noroozi, O., Biemans, H.J.A., & Mulder, M. (2016). Relations between scripted online peer feedback processes and quality of written argumentative essay. *Internet and Higher Education, 31*(1), 20-31.

Noroozi, O., Kirschner, P.A., Biemans, H.J.A., & Mulder, M. (2018). Promoting argumentation competence: Extending from first- to second-order scaffolding through adaptive fading. *Educational Psychology Review, 30(*1), 153-176. http://dx.doi.org/10.1007/s10648-017-9400-z.

Noroozi, O., Weinberger, A., & Kirschner, P. A. (2021). Technological and pedagogical innovations for facilitation of students' collaborative argumentation-based learning. *Special Issue on Innovations in Education and Teaching International, 58*(5), 499-500.

Noroozi, O., Weinberger, A., Biemans, H.J.A., Mulder, M., & Chizari, M. (2012). Argumentation-based computer supported collaborative learning (ABCSCL). A systematic review and synthesis of fifteen years of research. *Educational Research Review, 7*(2), 79-106. http://dx.doi.org/10.1016/j.edurev.2011.11.006.

Olivarez, N. (2012). The Impact of a STEM program on academic achievement of eighth grade students in a south texas middle school (PhD Thesis). Texas A & M University.

Oradee, T. (2012). Developing speaking skills using three communicative activities (discussion, problem-solving, and role-playing). *International Journal of Social Science and Humanity, 2*(6), 533.

Ozkan, Z.C. (2022). The Effect of STEAM Applications on Lesson Outcomes and Attitudes in Secondary School Visual Arts Lesson. *International Journal of Technology in Education (IJTE), 5*(4), 621-636. https://doi.org/10.46328/ijte.371

Öztürk, B.İ & Arıca-Akkök, E (2019). Developing Rating Scale to Assess Speaking Skills for Turkish Native Speakers. *Elementary Education Online, 18*(1), 416-436.

Peregoy, S., & Boyle, O. (2012). *Reading, writing and learning in ESL: A resource book for teachers*. New York: Allyn & Bacon.

Pourhossein Gilakjani, A., & Sabouri, N.B. (2017). Advantages of using computer in teaching English pronunciation. *International Journal of Research in English Education, 2* (3), 78-85

Puren, C. (2004). L'evolutıon Historique Des Approches En Didactique Des Langues-Cultures ou Comment Faire L'unite Des « Unites Didactiques », Congrès Annuel de l'Association pour la Diffusion de l'Allemand en France (ADEAF), *École Supérieure de Commerce de Clermont Ferrand*, 2-3 Novembre 2004, France.

Razi, A. & Zhou, G. (2022). STEM, iSTEM, and STEAM: What is next? *International Journal of Technology in Education (IJTE), 5*(1), 1-29. https://doi.org/10.46328/ijte.119

Rodríguez Seara, A. (2004). L'évolution des méthodologies dans l'enseignement du français langue étrangère depuis la méthodologie traditionnelle jusqu'à nos jours, Cuadernos del Marqués de San Adrián: Revista de humanidades, no. 1, http://www.uned.es/ca-tudela/revista/

Rodríguez-Nieto C. A. & Alsina Á. (2022). Networking Between Ethno-mathematics, STEAM Education, and the Globalized Approach to Analyze Mathematical Connections in Daily Practices. *Eurasia J. Math. Sci. Technol. Educ.* 18, 23–25. 10.29333/ejmste/11710

Salı, P. (2015). *Language teaching. natural approach*. (Editor: Nilüfer Bekleyen). Ankara: PEGEM Akademi:

Sanders, M. E. (2009). STEM, STEM education, STEMmania. *Technology Teacher, 68*(4), 20-26.

Scrivener, J. (2005). *Learning teaching: A guidebook for English language teachers* (2nd ed.). Oxford: Macmillan

Seitenova, S.S. (2014). Mode of study of the Kazakh language in view of psychological factors. *Life Science Journal, 11*(6): 201-205]. http://www.lifesciencesite.com. 38

Seitenova, S.S., & Zhaksylykova, A.A. 2021. Increasing students' cognitive interest by using STEAM technology in primary school. *Baishev University Bulletin, 4*(70)

Seitenova, S.S., Vasich, B.K. (2022). *Teaching manual on the subject "Methodology of literacy"*. Aktobe.

Şengül, K., & Sünbül, A.M. (2015). An Investigation into Comprehension Competence and Grammar Achievements of Learners of Turkish as a Foreign Language in Turkey. *Educational Alternatives*, 13, 573-580.

Serhan, D. & Almeqdadi, F. (2021). Exploring middle school students' interest and their perceptions of the effect of STEM education on their future careers. In M. Shelley, I. Chiang, & O. T. Ozturk (Eds.), *Proceedings of ICRES 2021-- International Conference on Research in Education and Science* (pp. 1-10), Antalya, TURKEY. ISTES Organization.

Shyamlee, S. D., & Phil, M. (2012). Use of technology in English language teaching and learning: *An analysis. Paper presented at the International Conference on Language*, Medias and Culture

Song, J. B., Shin, S. B. & Lee, T. W. (2010). A study on effectiveness of STEM integration education using educational robot. *The Korean Society of Computer and Information, 15*(6), 81-89.

Sparks, R.L. & Ganschow, L. (1996) Teachers' Perceptions of Students' Foreign Language Academic Skills and Affective Characteristics. *The Journal of Educational Research, 89*(3), 172-185. DOI: 10.1080/00220671.1996.9941323

Su, Y.S., Lai, C.C., Wu, T.K., & Lai, C.F. (2022). The effects of applying an augmented reality English teaching system on students' STEAM learning perceptions and technology acceptance. *Front Psychol.* 14, 13:996162. doi: 10.3389/fpsyg.2022.996162. PMID: 36312104; PMCID: PMC9614323.

Sun L., Hu L., Yang W., Zhou D., & Wang X. (2021). STEM learning attitude predicts computational thinking skills among primary school students. *J. Comput. Assist. Learn.,* 37, 346–358. 10.1111/jcal.12493

Sung, E. S. & Na, S. (2012). The effects of the integrated STEM education on science and technology subject self-efficacy and attitude toward engineering in high school students. *Korean Technology Education Association, 12*(1), 255-274.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6 th ed.). Boston: Pearson.

Tomlinson, B. (2001). Materials Development. In R. Carter & D. Nunan (Ed.), *The Cambridge Guide to Teaching English to Speakers of Other Languages*. Pp.66-72.

Turebayeva, K., Seitenova, S, Yessengulova, M., Togaibayeva, A., & Turebayeva Sh. (2020). Nurture of Multiculturalism of Future Teachers in The Process of Foreign Language Teaching. *Journal of Research in Applied Linguistics*, E-ISSN: 2588-3887 – http://rals.scu.ac.ir © 2020 – Published by Shahid Chamran University of Ahvaz

Tytarenko, A.A., Revenko V.V., Matsepura L.L., & Panasiuk Y.V. (2021). STEAM Approach to the Development of Future Teachers' English Language Skills. *J. Educ. Teach. Train.,* 12, 155–164.

Ur, P. (1996). *A course in language teaching, Cambridge teacher training and development*. UK: Cambridge University Press

Venville, G., Wallace, J., Rennie, L. & Malone, J. (2000). Bridging the boundaries of compartmentalised knowledge: Student learning in an integrated environment. *Research in Science & Technological*

Education, 18(1), 23-35.

Vergnaud, C. (2008). *Dédramatiser La Production Orale*. IUFM de l'Académie de Montpellier

Wang, H.H. (2012). A New Era of Science Education: Science Teachers' Perceptions and Classroom Practices of Science, Technology, Engineering, and Mathematics (STEM) Integration. [Doctoral dissertation, University of Minnesota]. https://conservancy.umn.edu/handle/11299/120980

Warschauer, M. (2000). The death of cyber space and the rebirth of CALL. *English Teachers' Journal*, 53, 61–67.

Wilson, C., Campbell-Gulley, B., Anthony, H.G., Pérez, M., & England, M.P. (2022). Integrated STEM Education: A Content Analysis of Three STEM Education Research Journals. *International Journal of Technology in Education and Science (IJTES), 6*(3), 388-409. https://doi.org/10.46328/ijtes.371

Yang, D. & Baldwin, S.J. (2020). Using Technology to Support Student Learning in an Integrated STEM Learning Environment. *International Journal of Technology in Education and Science (IJTES), 4*(1), 1-11.

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