Iranian Journal of Educational Sociology

Iranian Journal of Educational Sociology
http://www.injoeas.com
(Interdisciplinary Journal of Education)
Available online at: http://www.iase-idje.ir/
Volume 5, Number 3, October 2022

Designing a STEAM-based Educational Learning Package of Social Sciences Textbooks Based on the Thinking Design Model and Evaluating its Effectiveness on Problem-Solving Ability, Creativity, and Attitudes of Primary School Students

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Article history:
Received date: 2022/04/16
Review date: 2022/07/12
Accepted date: 2022/09/13

Keywords:
Attitude, Creativity, Social Sciences, Problem-Solving Ability, STEAM

Purpose: STEAM is the term given to a growing field of research and practice that integrates arts and social sciences into traditional sciences, technology, engineering, and mathematics subjects. The purpose of this study is to develop a STEAM-based educational learning package of social sciences textbooks and investigate its effect on the attitude, problem-solving ability, and creativity of sixth-grade primary school students of Bushehr in Iran. The design thinking model was used to design the training package.

Methodology: The present study was quantitative applied research. The research design is quasi-experimental with pre-test and post-test with the experimental and control group (unequal control group). The statistical population of this study included all students studying in the sixth grades of public primary schools in Busher in the academic year 2020-2021. Due to the nature of the research which is quasi-experimental and also with respect to the subject drop, 44 participants were considered as the statistical sample (22 students in each group) and they were selected by "accessible" purposeful sampling and randomly divided into experimental and control groups. The STEAM training package was designed in 13 sessions and each training session took a 35-minute duration in the form of 14 projects, and its implementation lasted for 2 months. In order to design each social science lesson project, a focus group meeting was held with the members. Data were collected based on three questionnaires: Hepner and Kruskal's problem-solving skills test, Shaffer's creative attitude survey, and Aiken's scientific attitude test. The face validity of the educational package was confirmed using experts' opinions. In order to check the hypotheses of this research, covariance analysis was used.

Findings: The presuppositions of the statistical test of covariance analysis, including the Kolmogorov- Smirnov test for the normality of the research variables and Levin's test for the homogeneity of the variances of the educational variables were confirmed. After that, the effects of the implementation of the steam-based educational package were investigated, and the results of the covariance analysis showed that the implementation of the educational package had an effect of (0.94) on creativity and problem-solving (0.90), and attitude (0.97) on students. The results of the Kolmogorov-Smirnov test showed that the creativity, attitude, and problem-solving skills variables of students have a normal distribution ($p > 0.05$). The results of the Levin test indicate that these assumptions are confirmed ($p > 0.05$).

Conclusion: Based on the findings, it can be concluded that the STEAM-based training package increases problem-solving ability, creativity, and a positive attitude towards the course of social sciences.

Please cite this article as: Zarei M, Zainalipour H, Samavi A. (2022). Designing a STEAM-based Educational Learning Package of Social Sciences Textbooks Based on the Thinking Design Model and Evaluating its Effectiveness on Problem-Solving Ability, Creativity, and Attitudes of Primary School Students, **Iranian Journal of Educational Sociology.** 5(3): 54-66.

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[DOR: 20.1001.1.26453460.2022.5.3.5.7]
[DOI: 10.61186/ijes.5.3.54]

1. Introduction

The school is the most important social institution that provides equal educational opportunities for individuals. Schools in the third millennium possess the legacy of those ideas on which the glorious human civilization has been founded in social sciences and technology areas (Shaykheifini, Raissi, & Zainalipour, 2021). Social Science is one of the most important subjects in early education due to its relevance to students' lives and the universally applicable problem-solving and critical thinking skills it uses and develops. These are lifelong social skills that allow students to generate ideas, weigh decisions intelligently and even understand the evidence behind public policymaking in society. Teaching technological literacy, critical thinking, and problem-solving through social sciences education gives students the skills and knowledge they need to succeed in school and society (Arrieta, Dancel, & Agbisit, 2020).

STEAM education is defined as an interdisciplinary approach integrating the development of knowledge and skills in social sciences, technology, engineering, arts, and mathematics (English, 2016; Ata Aktürk & Demircan, 2017; Campbell et al., 2018). Since STEAM first emerged as an initiative of the Rhode Island School of Design in 2008 as a reaction to the defunding of the arts caused by a global financial downturn (Allina, 2018), it has steadily evolved to become a field with the potential for transformative learning, especially when the arts are given equal status among the STEM subjects (Mejias et al., 2021). Such equal status boosts the likelihood of STEAM programs succeeding in engaging new audiences in transdisciplinary learning (Guyotte et al., 2015; Liao, 2016; Patton & Knochel, 2017; Sochacka et al., 2016).

The main difference between STEM and STEAM is that STEM explicitly focuses on scientific concepts. STEAM investigates the same concepts but does this through inquiry and problem-based learning methods used in the creative process (Wade-Leeuwen, et al, 2018). Nowadays, governmental guidelines and tests often mostly focus on primary and early school-level STEAM education. Yet, many educators believe social science education should begin earlier. Not only does social science education teach young learners problem-solving skills that will help them throughout their schooling in society, but it also engages them in social sciences from the start (National Research Council,2012). In 2012, the idea of STEAM training began to achieve a greater ability in innovative schools across the United States and the rest of the world. "A" in STEAM means the representation of arts and humanities, and its application was to increase participation in the Strings through an attempt to adapt the art to educational examinations in primary schools. Proponents of Steam argue that combining art is essential to innovation, as it combines problem-solving, creativity, and a positive view of society (Haris,2012).

The STEAM educational model is a completely new concept as it is based on integrating subject matter and collaboration amongst educators. Educators and practical communities use STEAM as a fun and creative way to build commitment to student social learning. STEAM programs in schools place more emphasis on the presentation of arts, social sciences, and technology; they are integrated with the social science curriculum and focus on engineering activities (Quigley & Herro, 2019). The STEAM-based approach is to link the learning concepts of the materials, especially the integration of the concepts of social sciences and various types of design and painting, crafts, photography, display, and music to foster the students' learning skills. The arts and social sciences in this STEAM-based research refer to materials that are inherently creative, such as music, images, visual arts, literature, drama, games, and humor.

The question of how to foster innovation and creativity by using initiative and curiosity in problem-solving can find its response in the design thinking model. The design thinking model provides a framework for students seeking rich problem-solving experiences. This educational model has an artistic and scientific approach that is based on creativity, curiosity, and interdisciplinary approach which play a vital role in the design thinking process. Nonlinear and endless concepts are embedded in the term "design thinking" because it provides a model that teachers and learners may follow and adapt to their circumstances. Design thinking is a process that connects creativity with analysis (Henriksson, 2017).

Although there have been serious increases in recent years in the number of social sciences studies in which creativity has been investigated and studies that examine the effect of STEAM education on the creativity of

[DOR: 20.1001.1.26453460.2022.5.3.5.7]
[DOI: 10.61186/ijes.5.3.54]

students are very few abroad and this study is the first one that conducted in Iran. There are a few studies that addressed STEAM-based educational learning with their results. For instance, a study conducted by Ona Monkeviciene (2021) revealed that the application of innovative STEAM education practices had effects on teacher professional development and the implementation of STEAM education encourages the self-directed improvement of teacher professional competencies. Teacher professional development has an essential impact on the development of children's STEAM education. Ozkan and Topsakal (2019) used the STEAM design process program to investigate middle school seventh-grade students' creativity and discovered that the students' verbal and numerical creativity had significantly improved. Kong and Huo (2014) conducted a study at the elementary school level. They observed that most of the teachers had positive views of the STEAM education model, but their experience of performing such activities was low. The reason for this situation is that teachers did not receive training in the in-service and pre-service teacher training processes within the framework of STEAM training activities.

The use of STEAM-based educational package in teaching basic sciences, especially social sciences, can increase students' creativity and reduce learning problems, including core memory. The issue of the non-application of what we have learned and its concepts is one of our educational problems that can be solved by using the STEAM-based training package. Also, the connection of different aspects of STEAM education and humanities, and the integration of disciplines in a proper way are other advantages of using the STEAM approach.

A review of specialized and organized resources in the field of Social Science Curriculum shows that no attempt has been made to design a STEAM-based Educational Learning Package Based on the Thinking Design Model in Iran so far. The documentary pieces of evidence show that the Social Science Curriculum in our country has not been able to cultivate the spirit of social science, exploration, creativity, and thinking skills in students. The International Mathematics and Science (TIMSS) results show that Iranian Primary Social Science Curricula have many weaknesses and our students don't have the sufficient skills to construct hypotheses, analyze data, solve problems, and apply scientific tools and methods. Also, the environmental research setting is at a very low level. Moreover, art and social science education have never gained a major place in either public school curricula or educational research in our country (Iran), even though specialists in art and social education have been active for many years and the art and social science curriculum are generally recognized as an essential aspect of the past and present culture. One of the main issues and challenges facing educational and curriculum planners is how to establish a relationship between art and social science curricula and other subjects in Primary school which should provide the relevant knowledge.

Designing and implementing a STEAM-based Educational Learning Package strengthens students' creativity through the application of art and a social-centered approach in education, and on the other hand, using the design thinking model in teaching causes a positive attitude toward learning social sciences and strengthening students' skills. Therefore, the main purpose of this study is to design a STEAM-based Educational Learning Package of Social Sciences Textbooks of Primary School based on the Thinking Design Model and to evaluate its effectiveness on problem-solving ability, creativity, and a positive attitude towards social sciences in sixth-grade primary students. The present study addressed the subsequent hypotheses as follows:

H1. The implementation of the STEAM-based educational package of social sciences textbooks has an effect on students' creativity.

H2. The implementation of the STEAM-based educational package of social sciences textbooks has an effect on students' attitudes toward the course of the social sciences.

H3. The implementation of the STEAM-based educational package of social sciences textbooks has an effect on students' problem-solving skills.

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2. Methodology

The present study was quantitative applied research. The research method is quasi-experimental with pre-test and post-test with experimental and control groups (unequal control groups. The statistical population of this study included all students studying in the sixth grades of public primary schools in Busher in the academic year 2020-2021. Due to the nature of the research which is quasi-experimental and also with respect to the subject drop, 44 participants were considered as the statistical sample (22 students in each group) and they were selected by "accessible" purposeful sampling and randomly divided into experimental and control groups. In an experimental study, the appropriate number of samples for each group is 15 participants (Dellavar,1390). Data was collected using the following questionnaires.

Instruments

1-The Problem-Solving Inventory (PSI)

The Problem-Solving Inventory was used to measure participants' levels of perceived problem-solving confidence. The Problem-Solving Inventory has been developed by Heppner and Kruskal (1982) to determine the dimensions of the problem-solving methods and to determine how the person perceives the competence to solve problems. The 35 items on the PSI asked respondents to determine how much they agreed or disagreed with each statement by selecting a point on a scale from 1 (strongly agree) to 6 (strongly disagree). In this inventory, such problem-solving stages as "general tendency", "the definition of the problem", "develop alternatives", "decision making" and "evaluation" have been taken into account. As a result of the factor analysis conducted by researchers, it is stated that the scale consists of six factors. These factors are as follows: 1. Impetuous Approach = 0.78, 2. Considering Approach = 0.76, 3. Avoidant Approach = 0.74, 4. Evaluator Approach: = 0.69, 5. Self-Assured Approach: = 0.64, 6. Planned Approach= 0.59. The internal consistency reliability coefficient (Cronbach Alpha) was found as 0.90.

2-Aiken science attitude tester

The Aiken science attitude tester consists of 16 closed-ended items created by (Aiken, 1979). It consists of five Likert items that are represented on a 5point continuum (1=completely disagree to 5=completely agree). The Cronbach's Alpha Coefficient for the whole sample was 0.88. In this study, the Cronbach's Alpha Coefficient of this Questionnaire showed a total estimation of 0.97 indicating that the instrument enjoyed a good degree of reliability. In the current study, ten experts confirmed the validity of this questionnaire.

3-Schaefer's Creative Inventory

Schaefer's Creative Inventory consists of 165 closed-ended items created by (Schaefer, 1970). One hundred and sixty-five questions are grouped into five sections: physical characteristics, family history, educational history, leisure time activities, and a miscellaneous category. The inventory has several dimensions measuring different fields of creative endeavor. Boys are ranked on a math-science dimension and an art-writing dimension. Girls are ranked on a writing dimension and an art dimension. Several validation studies have been conducted using the Measurement of creativity. In this study, the Cronbach's Alpha Coefficient of this Questionnaire showed a total estimation of 0.94 indicating that the instrument enjoyed a good degree of reliability. In the current study, ten experts confirmed the validity of this questionnaire.

Procedure

Before the implementation of the educational package, a pre-test was conducted in two experimental and control groups. The training sessions were held by a trained teacher and supervised by a researcher. Training sessions were held two days a week and for 2 months in the sixth grade of Shahid Monfared Primary School in Bushehr in the form of 13 training sessions, and each training session took a 35-minute duration and 14 projects. Inclusion criteria included lack of mental or physical diseases affecting mood states, lack of experience of stresses such as parents' divorce, and death of relations in recent months as well as the desire and satisfaction of participating in the project. The subjects did not drop out and all completed the training course.

The structure of the training sessions was as follows:

[DOR: 20.1001.1.26453460.2022.5.3.5.7]
[DOI: 10.61186/ijes.5.3.54]

1-Reviewing the projects of the previous meeting (5 minutes).
2-Resolving problems and ambiguities and questions and answers (3 minutes).
3- Grouping students and presenting a new project and how to build and test it (20 minutes)
4-Discussion (5 minutes).
5-Receiving feedback (2 minutes).

At the end of the training course, a post-test was taken from the experimental and control group, and the obtained data were analyzed with SPSS 22 software. The unequal control group design consists of two groups that are compared to each other before and after exposure to the independent variable. This design is similar to the pre-test and post-test design with the control group, with the difference that in this design, subjects are not selected from the community and their replacement in the groups is not done randomly. Therefore, random selection and replacement are criteria by which these two types of designs can be distinguished from each other. One of the criteria for entering this research is the willingness to cooperate and willingness to participate in the design and implementation teams of steam-based projects, and the criteria for exiting the research is the lack of parental consent to participate in this research.

The design of the unequal control group consists of two groups, which are compared before and after being exposed to the independent variable. This plan is similar to the pre-test and post-test plan with the control group, with the difference that in the present plan, the subjects are not selected from the community and their replacement in the groups is not done randomly. Therefore, random selection and replacement are the criteria by which these two types of designs can be distinguished from each other. Although the two groups are unequal, the researcher seeks to select those who make the experimental and control groups as similar as possible.

In designing the training package, due to its importance and applicability, the design thinking model was used. The training package was compiled according to the following steps. The focus group was formed with the presence of the primary education experts and the sixth grades education department, the departments of art, mathematics, social sciences, work and technology, biology, and a purposeful sampling method was used in selecting the members of the focus group. The design of the projects was done based on the titles of the 6th-grade social science book, which is presented in the form of the table below. The training package was implemented in the form of 13 training sessions of 35 minutes and 14 projects. To design each project of social science courses, a focus meeting was held in the presence of members.

Table1. STEAM approach projects in the form of sixth-grade social science lessons

Lesson	Project Title	Math	Art	Engineering	Technology	Concepts of science
1	Making a wooden sculpture	Accurate measurement of wood pieces	Sculpture	Design the shape of the statue	Construction of electric circuit	gravity, energy
2	paper production	Area of rectangle, vertex,	Notebook design with waste paper	Notebook design	-	Recycle
3	Conducting salt and vinegar ink reaction test	Calculate the approximate weight of objects	Drawing an artistic shape on a balloon	-	-	properties of salt essence
4	Earth's Layers Embossed Office	Symmetry and coordinates, period	Drawing the art form of the globe	Designing the shape of the earth's layers	Questions and answers with an expert	Earth layers, volcanoes
5	The prominent Office of Safe Places of Asylum	Using the concepts of symmetry and coordinates	CD notebook design	The design of determining the safe points of the school	-	Earthquakes, safe places of refuge

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6	Making a paper airplane	Calculation of length and area, volume and mass	Coloring the designed plane	Paper airplane design	Using a mobile phone to share	force-friction
7	A. Making an electric motor b. Perform static electricity test	Calculate length, fraction, ratio, proportion, percentage	Coloring and drawing different shapes with paper napkins	A- Designing different shapes with paper napkins & different types of electric motors.	A- search the internet to learn about the types of electric motor design.	A. Electric motor - magnetic force, and friction force
8	Making a moving propeller	Approximate measurements, symmetry measurements	Painting and drawing butterfly wings	Construction and design of the metal frame of the movable propeller	Using a mobile phone to record and share the craft	Design and build
9	Making an electric circuit using a. Dough B. Potatoes	Measure the amount of energy produced, fraction, proportion, ratio	Making art forms with the help of made dough and potatoes	Design and construction of the electric circuit	Electrical circuit design -Online communication with electricity students	Different forms of energy - energy conversion
10	Cake baking	Fraction measurement, ratio, and proportion, approximation	Cake design and decoration	-	share the cake made	Mushroom-yeast
11	CD Photosynthesis Handbook	Coordinate measurement center, symmetry	Painting and drawing different forms of food	Embossed notebook design	Sharing products in virtual space -	Photosynthesis, food production in plants
12	Outstanding food chain brochure	Center for measuring symmetry, multiplication, and division of fractions	The stages of building a food web	CD notebook design	Communication with agriculture students virtually	The relationship between organisms and the living environment
13	Construction of an outstanding infectious disease (corona) office	Measuring the center of symmetry, rotation,	Designing the stages of entry of the coronavirus into the lungs	CD notebook design	Online communication with the health network	Coronavirus germ contagious disease
14	Creating a virtual group in internal and external messengers	Calculation of center of symmetry, rotation,	Using all kinds of software to design a virtual conference	Designing and personalizing the theme	Creating a virtual group in internal messengers	Changes in mobile phone technology and internal and external messengers.

In this research, a 5-stage rotational design thinking model was used to design educational package projects, which includes the following steps: problem definition, empathy, ideation, prototyping, and experimentation.

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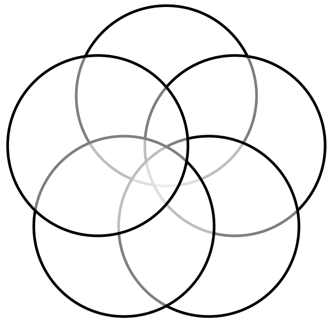

Figure 1. 5-step design thinking model presented by Visomazi & Mantiba, (2020)

Problem definition: The real problem is defined by exploring the local community to identify the target audience.
Empathy: Interviewing the audience to better understand their needs and see the needs.
Prototype: The actual creation and manufacture of the product occur at this stage.
Experiment: An opportunity to get feedback on solutions modifies solutions to improve them, and continue to learn about your users. In the design thinking model, empathy is emphasized as a practice that results from a deep understanding of users and a clear expression of their needs (Visomazi & Mantiba, 2020).

To check the content validity of the educational package by curriculum experts, it was reviewed by several curriculum experts, and its problems were fixed and their suggestions were applied. To determine the content validity, the Lawshe method was used. To determine the index and content validity ratio in the evaluation questions, 8 experts in the field of curriculum planning were selected and asked to comment on the appropriateness of each of the questions in the prepared forms (Lawshe, 1975).

3. Findings

Hypothesis 1-The implementation of the STEAM-based educational package has an effect on students' creativity.

Analysis of Covariance was used to investigate the implementation of the STEAM-based educational package on students' creativity. This test limits or eliminates the effect of random variables (pre-tests). For this purpose, the assumptions of the analysis of covariance were first examined. The results of the Kolmogorov-Smirnov test showed that the creativity variable of students has a normal distribution ($p > 0.05$). Levin test was used to evaluate the homogeneity of variance. The results of this Levin test indicate that this assumption is confirmed ($p > 0.05$). Another premise of this analysis is to examine the homogeneity of the regression slope and the results are given in Table (2).

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Table 2. Results of Analysis of Covariance to evaluate the implementation of the STEAM-based educational package on students' creativity

Sources of change	sum of squares	degree of freedom	mean squares	Statistics F	significance	size of effect
Modified model	3.516	2	1.758	388.068	0.000	0.50
Width of origin	0.485	1	0.485	107.041	0.000	0.23
Creativity pre-test	0.107	1	0.107	23.574	0.000	0.365
group	0.378	1	3.378	745.13	0.000	0.948
Error	0.186	41	0.005	-	-	-

The results of Table (2) show that after adjusting the pre-test scores, the effect size of the implementation of the Steam-based educational package on students' creativity is (0.948). Based on these results, the effect of STEAM-based education on students' creativity was 94.8% and these results are significant, and the hypothesis is confirmed.

Hypothesis 2-The implementation of the STEAM-based educational package has an effect on students' attitudes.

Analysis of Covariance was used to investigate the implementation of the Steam-based educational package on students' attitudes. This test limits or eliminates the effect of random variables (pre-tests). For this purpose, the assumptions of the analysis of covariance were first examined. The results of the Kolmogorov-Smirnov test showed that the creativity variable of students has a normal distribution ($p > 0.05$). Levin test was used to evaluate the homogeneity of variance. Levin test results indicate that this assumption is confirmed ($p > 0.05$).

Table (3) shows the results of the analysis of covariance to evaluate the implementation of the STEAM-based educational package on students' attitudes.

Table 3. Results of Analysis of Covariance to evaluate the implementation of the STEAM-based educational package on students' attitudes

Sources of change	sum of squares	degree of freedom	mean squares	Statistics F	significance	size of effect
Modified model	75.176	2	37.588	689.470	0.00	0.71
Width of origin	7.974	1	7.974	146.262	0.00	0.81
Creativity pre-test	0.262	1	0.262	4.808	0.034	0.105
group	71.937	1	71.937	1519.539	0.000	0.970
Error	2.235	41	0.005		-	-

The results of Table (3) show that after adjusting the pre-test scores, the effect size of the implementation of the STEAM-based educational package on students' attitudes is (0.970). Based on these results, the effect of STEAM-based education on students' attitudes was 97.0% and these results are significant and the hypothesis is confirmed.

Hypothesis 3-The implementation of the Steam-based educational package has an effect on students' solving-problems.

[DOR: 20.1001.1.26453460.2022.5.3.5.7]
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Analysis of Covariance was used to investigate the implementation of the Steam-based educational package to solve students' problems. This test limits or eliminates the effect of random variables (pre-tests). For this purpose, the assumptions of the analysis of covariance were first examined. The results of the Kolmogorov-Smirnov test showed that the variable of students' academic achievement has a normal distribution (p> 0.05). Levin test was used to evaluate the homogeneity of variance. Levin test results indicate that this assumption is confirmed (p> 0.05). Table (5) shows the results of the analysis of covariance to evaluate the implementation of the Steam-based educational package on students' problem-solving and academic achievement.

Table 4. Results of Analysis of Covariance to evaluate the implementation of the Steam-based educational package on students' problem-solving

Sources of change	sum of squares	degree of freedom	mean squares	Statistics F	significance	size of effect
Modified model	0.958	2	0.479	24.959	0.00	0.49
Width of origin	0.418	1	0.418	21.764	0.00	0.47
Creativity pre-test	0.113	1	0.113	5.867	0.020	0.125
group	0.953	1	0.953	49.44	0.000	0.900
Error	0.7870	41	0.019	-	-	-

The results of Table (4) show that after adjusting the pre-test scores, the effect of the implementation of the STEAM-based educational package on students' problem solving is (0.900). Based on these results, the effect of STAM-based education on students' problem-solving was 0.90% and these results are significant and the hypothesis is confirmed.

4. Conclusion

This study aimed to design, implement and evaluate the effectiveness of the STEAM-based educational package of the sixth-grade primary social sciences course based on the design thinking model. Since the design thinking model has a social-centered approach to innovation, in the design of the STEAM-based training package, it was used. The designers use it by combining the needs of people with technology and the requirements for success in activities (Visomazi and Mantiba, 2020). One of the methods emphasized in the design thinking model is to use a project-oriented approach. It makes the learning of experimental sciences meaningful for the learner. It relates to the learner's daily life and if applied, it results in gaining problem-solving skills, and creativity, and creating interest in social sciences in students. Furthermore, the real interdisciplinary space in the design thinking model for teaching STEAM allows each discipline to be presented in coordination with other disciplines. This kind of real integration of subject areas is emphasized in STEAM lesson plans with the good organization (Liao, 2016). According to the results of the data analysis, the design and implementation of the design thinking model have the necessary effect on the study sample.

One of the hypotheses of the research was the effect of implementing a STEAM-based educational package on students' problem-solving skills. The results showed that after presenting the training package to the experimental group, they answered the problem-solving skills test questions more than the control group, therefore, the hypothesis was confirmed. This finding is consistent with the results of research by Liu, and Vivo (2019), Hadingrahaningsia et al. (2017), and Dirosa (2017) on improving problem-solving skills through TEAM-based education. In explaining these findings, it can be stated that in STEAM teaching, teachers strengthen problem-solving skills through educational approaches such as observation, experience, repetition, and reasoning (Bernstein, 2019).

In addition, Herro, and Quigley (2019) conducted a longitudinal study on students who used cognitive skills to solve problems. The results of this study showed that the ability to transfer knowledge to new

[DOR: 20.1001.1.26453460.2022.5.3.5.7]

[DOI: 10.61186/ijes.5.3.54]

situations was greater among students. This kind of transferring knowledge is of particular importance in STEAM education due to the integrated nature of educational content (Herro, Quigley, 2019).

The first aspect of STEAM training is problem-based presentation. Teachers present content from several disciplines or domains related to the real-world processes from which the problems are extracted. To present content in a problem-based approach, problem-based learning is used in which learning frameworks do not have a correct response. In other words, this problem is unstructured and can be solved using a variety of research methods. Research shows that solving such a problem helps students understand that there are different ways to solve the problem.

The second hypothesis was to investigate the effectiveness of the implementation of the STEAM-based educational package on students' creativity. The results showed that after presenting the educational package to the students of the experimental group, they answered the creativity test questions significantly more than the control group. Therefore, the hypothesis was confirmed at a significant level. These findings are consistent with the results of research by Thai (2017), Quebec (2021), Ozkan & Topsakal (2021), Al-Sayari (2021), Wendry, Vijaya and Augustine (2018), Ferguson (2020), Cook (2012) and Manin (2016) that improve creativity through STEAM-based education.

According to these findings, it can be said that during STEAM learning, teachers use a variety of educational activities to develop creative skills. Advocators of STEAM believe that it is a surefire way to engage and prepare students for 21st-century skills and careers. This is an approach, in which topics of interest to students are given more importance (Gayot, et al. 2015). STEAM also includes learning methods that students enjoy, such as drawing, computer graphics, performing arts, creative thinking, and even fun problem-solving while exploring and designing problem-solving solutions (Harris, 2012). Today, students will face challenges and questions that require global thinking to solve. The types of questions they need to address include deep and cross-disciplinary issues that require comprehensive approaches to address. This requires a high level of creativity, and this is one of the reasons why creativity is one of the most important skills of the 21st century (Liao, 2016; Trailing and Fadel, 2009). Proponents of STEAM-based education believe that STEAM allows teachers to challenge their students to be more creative and effective problem solvers in today's competitive culture.

Creative problem solving through artmaking should be at the center of this approach. This view also accords with problem-based learning through which students learn by solving problems presented in a given project. This approach encourages students to see connections among their knowledge, skills, and abilities and to draw on these connections in advancing their own education and eventually in contributing to solutions to 21st-century problems (Liao, 2016). Through innovation and creative ideas, the procedures how to solve problems are strengthened, and creative learning is nurtured (Kim and Park, 2012). STEAM training strengthens creativity and awareness of opportunities to explore different paths in a variety of ways in students. The development of students' creative skills relies on the teacher's ability to provide concepts, tools, and experiences in open problem-solving lessons (Hero, Quigley, & Cain, 2019). According to Glass and Wilson (2016), many STEAM programs are designed on Project-based learning, which tangibly demonstrates the student's choice to participate collaboratively and creatively.

Regarding the hypothesis of evaluating the effectiveness of the implementation of the STEAM-based educational package on students' attitudes toward the course of the social sciences, the results showed that after presenting the educational package to the students of the experimental group, they have a significantly more positive opinion about the activities of the course of the social sciences than the control group in the science attitude test. Therefore, the hypothesis was confirmed at a significant level. These findings are consistent with the results of research by Diging, Ciutadji, Renan Tias et al., (2021), Rosmana, Bandari, & Land (2013). In explaining these findings, it can be said that the appropriate approach for effective teaching is problem-based curricula.

In a problem-solving learning environment, the basic concepts of the STEAM approach are naturally rooted in real-world problems. Generally speaking, the STEAM-based Training Package seeks to solve real-life problems using the Problem-solving approach (Guyot et al, 2015). Therefore, the educational package leads to an interest in social sciences by considering the real problems of students. One of the factors that teachers should consider when using the STEAM-based approach is that the learning issues are authentic. They originated in the real world, which means that they related to students' real lives, communities, and cultures. (Harrington, Reeves, and Oliver, 2014). Therefore, the authenticity of the problems has a positive effect on students' attitudes towards social sciences.

The STEAM-based approach emphasized the presence of specialized teachers in the classroom. They taught students to become aware of their personal experiences and the challenges they may face in their future careers. Not only do these specialized teachers provide first-hand experience and knowledge of the field, but they also provide students with a tangible example of how to transfer their learning beyond the walls of the classroom. Problem-based learning increases students 'communication and dependence on their learning, which in turn increases students' positive attitudes toward learning the social sciences (Norman and Schmidt, 2010).

This study also had some limitations, including the small sample size of subjects and the lack of selection of both sexes, the lack of research background in this regard in Iran, and the lack of experienced experts in the field of STEAM-based education. It is suggested to use both sexes in implementing and evaluating the effectiveness of the STEAM-based approach in subsequent research and to use the opinions of STEAM experts abroad in designing the training package. It is suggested that the implementation of the STEAM-based Training Package be used at other educational levels as well.

Conflicts of Interest

No conflicts of interest were declared.

[DOR: 20.1001.1.26453460.2022.5.3.5.7]
[DOI: 10.61186/ijes.5.3.54]

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[DOR: 20.1001.1.26453460.2022.5.3.5.7]

[DOI: 10.61186/ijes.5.3.54]