

Effects of Designing LEGO Robotics Instructional Practices on The Prospective Science Teachers' Resistive Behaviors Towards Technology Supported Instruction

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ABSTRACT

The study was conducted to determine the effects of designing LEGO robotics instructional practices (LRIP) on the prospective science teachers' resistive behaviors towards technology supported instruction (TSI) and their views on these instructions. Mixed method research was used. The study group was selected taking into account the criteria of one of the purposive sampling methods. The study group was made by 18 prospective teachers trained in the Science Education Department. The data were gathered with the help of data collection tools such as the resistive behavior scale and the questionnaire on resistance towards TSI. Data were collected using data collection tools such as a questionnaire on resistive behavior scale and resistance to TSI. Quantitative data were analyzed by t-test for dependent samples using SPSS, and qualitative data were analyzed by inductive content analysis method using Nvivo. Findings indicated that participants who designed LRIP participated more voluntarily in the TSI. Moreover, it was inferred from qualitative data that LRIP led to overcome the prospective science teachers' resistive behaviors to TSI. As a result of the study, it can be said that the prospective science teachers had positive opinions and perceptions on TSI after their experience of designing LRIP and integrated into the learning and teaching process.

Keywords: *LEGO, robotics, robotics instructional practices, technology supported instruction, resistive behavior.*

INTRODUCTION

What prevents educators from designing an effective learning and teaching process is the learners' affective properties. Since the learners' resistive behaviors towards learning and teaching process affect the quality of teaching process in a negative way, the learners' resistive behaviors should be overcome for functional instruction. In literature the learners' resistive behaviors towards learning and teaching process is termed as student's resistance (Giroux 2001). In the digital age technology supported instruction draws attention in the design of learning-teaching process in which the learners' needs and expectations are met. However, the previous studies indicated that the teachers, expected to be a designer of technology supported instruction, had negative attitudes towards technology use in education and their not having enough knowledge on how to integrate technology into instruction was a factor preventing them from preferring technology supported instruction (Cakir and Yildirim 2009). Furthermore, Yavuz Konokman (2015) emphasized that such factors as lack of different and new technology supported instructional practices, teachers' qualifications, instructional problems and the existence of negative attitudes towards technology

supported instruction led to the prospective teachers' resistance towards technology supported instruction. Resistance, defined as an opposition to the instructional process, is an obstacle which should be overcome to have qualified education.

What distinguishes the resistive behaviors from the undesirable behaviors of the students is that the resistive behaviors are planned and shown continuously (Yuksel 2004). For example, when a student gets bored in the lesson, he/she draws suddenly a picture on his/her notebook. This is an example for an undesirable student behavior. That the behavior is continuously shown because of the negative attitudes towards the course or the teacher indicates that the undesirable student behavior turns into the resistive behavior (Yuksel 2004). In contrast to the undesirable student behaviors, the resistive behaviors, shown continuously and in a planned way, are difficult to be overcome. What is important is the possibility of the prevention of the students' resistive behaviors by means of developing the teaching activities and improving the learning environments (Burroughs et al. 1989). In literature Alpert (1991) states that the learners oppose to the teaching activities by being silent, not answering the question asked by the teacher or answering the question in a low voice, discussing with the teacher, etc. Higginbotham (1996) also categorizes the resistive behaviors as oral resistance, silent resistance and breaking down the lesson. According to Higginbotham (1996), that the learner manipulates the instructional activity by asking many irrelevant questions or criticizing the activity exemplifies the oral resistance. That the learners reject to participate in the teaching activities and become silent during the lesson is an example for the silent resistance. Moreover, the learners' breaking down the lesson and being absent from the school are the indicator of the resistive behavior. Having researched resistive behavior in higher education, Burroughs et al. (1989) classify these behaviors into 19 categories: making suggestion to the teacher, accusing the teacher, breaking down the lesson, unwilling adaptation, showing direct resistance, deceiving, communicating directly, prevention, apologizing, not taking care of the teacher, saying your priorities are different, forcing the teacher, taking support from other students, complaining, taking the teacher as a model, defending oneself, confuting, revenging.

In literature that considers it is observed that many researchers focus in general on the learners' resistive behaviors towards instructional activities. Only one researcher examined the resistive behaviors of learners towards integrating technology into instruction (Yavuz Konokman 2015). Yavuz Konokman (2015) defines resistance towards technology supported instruction as the learners' opposition against integration of technology into instruction. Determining the resistive behaviors to technology-supported instruction and making the necessary arrangements to overcome these behaviors are required in the digital age, especially when technology is frequently integrated with teaching. Moreover, it is inferred from the research that both the teachers and prospective teachers explain the reasons for their resistive behaviors towards technology supported instruction by the lack of new and different technology based instructional practices at the faculty of education (Yavuz Konokman 2015) In that case it comes into prominence that the learners should be given the chance to encounter new and different technology supported instructional practices in order to have positive attitudes towards technology supported instruction and to accept the use of technology for educational purposes. Moreover, Lin and Lu (2010) emphasize that teachers' pre-service and in-service education play an important role on teachers' skills in integrating technology with instruction. For this reason, education faculties need to provide the prospective teachers experience in designing technology-supported instruction. Because it is necessary for both teachers and prospective teachers to have enough knowledge to integrate technology with instruction (Harris et al. 2006).

LEGO Robotics Instructional Practices

Nowadays, in learning and teaching environments, various technologies with different properties are used as educational technologies. Augmented reality, virtual reality, adaptive learning environment, online learning, mobile learning and flipped classroom are some of the ever-developing educational technologies commonly used in education (NMC 2017; Johnson et al. 2016; Adams-Becker et al. 2016). In addition to these technologies, educational robotic practices are ranked as an important ever-developing technology in the field of educational technology (Johnson et al. 2016). LEGO robotics instructional practices are among the products of LEGO Mindstorms and popular educational robotics practices commonly used for educational purposes.

LEGO products are a kind of toy made of different colored pieces and can form a structure with the help of interconnected bricks. In addition to these bricks, this LEGO set which includes light, ultrasonic, audible, touch sensors, servo motors and a programmable part, called LEGO Mindstorms products. LEGO Mindstorms products are periodically updated. The last one of the LEGO Mindstorms products was presented to the market in 2013 under the name of LEGO Mindstorms EV3. LEGO Mindstorms EV3 was advertised as a device that encourages learners to learn to solve real problems (LEGO Education 2014). LEGO Mindstorms products, programmed to perform the planned duties is called LEGO robotics instructional practices. LEGO robotics products can be programmed in different programming languages. However, LEGO Mindstorms EV3 products are generally programmed in the LOGO programming language (Graphic Output Language). When the literature is reviewed, many studies related to LEGO robotics instruction are encountered. When these studies are reviewed, it is observed that LEGO robotics instructional practices lead students to take an active role in the lesson and understand the abstract concepts and to learn actively (Chambers et al. 2008). In addition, LEGO robotics instructional practices affect the motivation and attitudes of students towards the course (Murillo et al. 2011; Ozdogru 2013, Cukurbasi and Kiyici 2017). Moreover, the use of LEGO for educational purposes has positive effects on the success of the students (Ozdogru 2013, Strawhacker and Bers 2015, Cukurbasi and Kiyici 2017).

Contrary to LEGO robotics instructional practices, there is a limited number of qualitative studies on learners resistance, the reasons for learners' resistance, the types of resistive behaviors (Burroughs et al. 1989; Bryant and Bates 2010; Shimazoe and Aldrich 2010; Mthethwa-Sommers 2010; White 2011). Furthermore, studies on learners' resistive behaviors considered the effect of the quality of education are limited in Turkey (Yuksel 2004; Yuksel 2006, Sever et al. 2010). It is explicit that educational researchers should focus on and overcome the resistive behavior of students. It is thought that determining the resistive behaviors of the students and overcome these behaviors is especially important in the digital age when the technology is often integrated with instruction. The absence of new and different technology based instructional practices at the faculty of education is the reason for the prospective teachers' resistive behaviors towards technology supported instruction (Yavuz Konokman 2015), this study is thought to offer that the resistive behaviors can be overcome by means of LEGO robotics instructional practices. It is considered that common use of LEGO robotics instructional practices at faculty of education to overcome the prospective teachers' resistive behaviors will solve the problems in training digital teachers.

Equipping faculty students with right technology skills is one of the goals of the science curriculum and teachers are responsible for training the students to be literate in technology and the prospective science teachers should be familiar with the new, original and different technology supported instructional practices. In this context, it is expected that prospective science teachers who design LEGO robotic instructional practices will be successful practitioners of the science curriculum. Considering the popularity of LEGO robotic teaching in the world, it is expected that this research will be important in training of teachers who design successful LEGO robotic instructional practices. Taking all these reasons into consideration, it is aimed to determine the effects of designing LEGO robotics instructional practices on resistive behaviors of teachers towards technology supported instruction and on their views and perceptions of technology supported instruction. Accordingly, the following research questions were answered:

1. Is there any statistically meaningful difference in the resistive behaviors of prospective science teachers before and after designing LEGO robotics instruction?
2. What are the views of the prospective science teachers designing LEGO robotics instructional practices on technology supported instruction?

RESEARCH METHOD

Research Model

This study is conducted to determine the effects of designing LEGO robotics instructional practices on the prospective science teachers' resistive behaviors to technology supported instruction, mixed method is

used. Greene (2007) describes the research that mixed method is used as the study in which both qualitative and quantitative data are gathered and analyzed together subsequently inferences are made by correlating the findings. The mixed method is effective in increasing the reliability and validity of the research and making the research phenomenon more understandable (Greene 2007). Tashakkori and Teddye (2003) state that the mixed method is superior to other research methods. According to them, the reasons for the superiority of the mixed method are presenting different views, making strong inferences, answering to research questions, not being able to be answered by other research methods. In this study, research problem was examined in detail both with qualitative and quantitative research approaches. The prospective science teachers' resistive behaviors towards technology-supported instruction and their views on technology-supported instruction were revealed in detail by collecting both quantitative and qualitative data before and after designing process of LEGO robotics instructional practices.

Creswell and Plano Clark (2007) describe mixed method research with six designs: convergent-parallel, explanatory-sequential, search-sequential, embedded, transformative, and multiphase. Given the classification of Creswell and Plano Clark (2007), the current study used a convergent parallel design. According to this design, quantitative and qualitative data are collected (simultaneously in the same research phase). Both have equal significance, neither quantitative nor qualitative data are prioritized. After analyzing, quantitative and qualitative data are compared and interpreted together to explain the same phenomenon. In this case, the quantitative data about the resistive behavior of the respondents to the design LEGO pre and post-LRIP are then supported by qualitative conclusions. Furthermore, when designing LEGO robotic teaching practices, the cognitive and emotional experiences of prospective teachers were revealed with the help of qualitative data. The research model is shown in Figure 1.

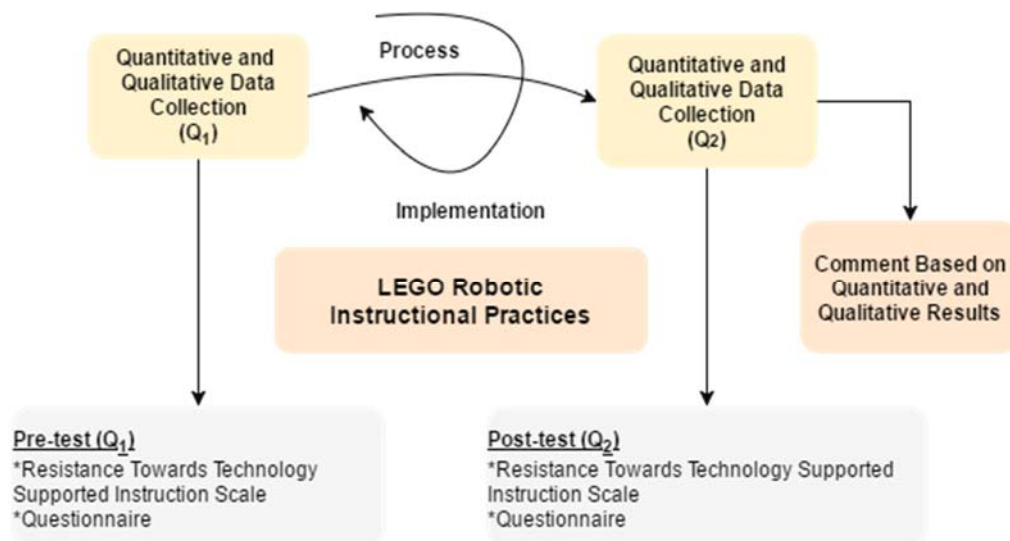


Figure 1. The Research Model

The Study Group

The study group was selected by the sampling criteria, one of the purposive sampling methods. Voluntary participation in the study and doing the homework and worksheets regularly were the selection criteria of the study group. Therefore, the study was conducted with the participation of 18 prospective teachers studying in Science Education Program at Bartın University during the 2016-2017 academic year. Participants were not informed before participating in research on robotic products such as LEGO Mindstorms EV3. For the LEGO robotics instructional practices, the study group was divided into three separate groups of six individual. A computer with the LOGO program installed and the LEGO Mindstorms EV3 training kit were ready to be used by each group.

The Application Process

The study was conducted in the studio of the Bartın University Distance Learning Research Center A

computer with the LOGO program installed and the LEGO Mindstorms EV3 training kit were ready to be used by each group. The themes on teaching science were provided by the researchers. The teaching field established with roads and LEGO bricks were called the theme field. Information on the application process of the research is given below.

1st Week: Information on LEGO robotics instructional practices and the planned studies were given to the study group. The criteria of the participation in the study were stated. The study group was selected. The study time was decided by regarding the participants' courses, their social life and their leisure time.

2nd Week: Resistance towards technology supported instruction scale and the questionnaire were applied. The information on LEGO Mindstorms EV3 set, robot designing process was given in detail. The guidebooks on how to design robot, prepared by the researchers, were given to the participants. The participants were divided into 3 groups. During the robot designing process the researchers' roles were coaching and guiding. The designed robots were tested.

3rd and 4th Weeks: The researchers gave feedback on the designed robots to the participants. The groups rearranged the robots by considering the feedbacks. The researchers gave information on how to program the robots. The groups programmed their robots and tested them. The notes on how to program the robot prepared by the researchers were given to the groups

5th Week: The theme field was shown to the groups and the operations were explained. The documents on the operations were given to the groups. The groups started to solve the problems on the themes. Then the groups were asked to prepare a worksheet on the solution of the problem by using LEGO Mindstorms EV3. Moreover, they were asked to draw a field on a paper.

6th Week: The worksheets were gathered. Six worksheets selected randomly were investigated by both researchers and participants. The necessary feedbacks were given and suggestions were made. The groups continued to solve the problems on the themes. The groups were asked to prepare a course plan based on the solution of the problem on the theme with the help of LEGO Mindstorms EV3 set. The groups were asked to prepare a course plan based on technology supported instruction.

7th Week: The course plans were investigated by the researchers and the groups. The groups evaluated their own and other groups' course plans and the feedbacks were given. The corrections on the plans were made.

8th Week: The design of LEGO robotics instruction practices and the integration of these practices into Science course finished. Resistance towards technology supported instruction scale were applied again. The questionnaire were applied again.

Sample and Data Collection

Resistance towards Technology Supported Instruction Scale: With the help of the resistance scale developed by the researcher, the resistive behaviors of prospective science teachers to technology-supported instructions were determined before and after the designing of LEGO robotics instructional practices and the integration of these practices into Science course (Yavuz Konokman 2015). Exploratory factor analysis indicated that the scale has five components and one factor. The five components altogether explain 57.136% of the total variance. The first factor has an eigenvalue of 12.617, which is six times greater than the eigenvalue of the second component (2.584), indicating that the scale has a single factor structure. Whole scale's Cronbach alpha reliability parameter was calculated as .906. The scale components's Cronbach alpha reliability parameters were found to be .91, .872, .87, .778, and .831, respectively. Moreover, the test and retest analysis results showed a positive and medium correlation between the pre-test and post-test scores ($r=.354$, $p<.05$). As a result of confirmatory factor analysis, goodness-of-fit indices for the model (GFI=.90; CFI=.99; IFI=.99; NNFI=.98; RMSEA=.057; CFI=.99; AGFI=.88.) proving that the model has excellent fit. Moreover, the model's appropriateness to the observed structure can be stated based on the finding that $\chi^2/df \leq 5$ ($1890.06/490= 3.857$). Thus, explanatory and confirmatory factor analysis and reliability analysis proved the reliability and validity of the resistance scale to determine whether prospective teachers had

resistive behaviors toward technology-supported instruction.

Questionnaire: The questionnaire, including open-ended questions for the prospective teachers so that they could explain their views in detail, was applied to determine their resistive behaviors towards technology supported instruction and the effects of designing LEGO robotics instructional practices on their behaviors. Firstly, the problem was defined while preparing the questionnaire. At this stage, the question "What kind of information do you plan to reach with this measurement?" was answered. After answering the question, the items describing the problem in detail were written down. The views of experts from the departments of Computer and Instructional Technologies as well as Curriculum and Instruction were received for the drafted items. In addition to the views of experts from the Computer and Teaching Technology departments, Curriculum and Instruction were also taken for draft items. Necessary corrections were made in accordance with the opinions of the experts and the questionnaire took its final form.

Analyzing of Data

SPSS 22 program was used to analyze quantitative data. In the analysis of the data related to the first problem question, "Is there any statistically meaningful difference in the prospective science teachers' resistive behaviors before and after designing LEGO robotics instruction?" The difference between the pre-test and post-test mean scores was tested. First, the dependent variable for the normal distribution was examined to make the difference tests. The Shapiro-Wilk test ($n < 30$) was performed to indicate whether pre-test and post-test mean scores of the group were distributed normally for resistive behaviors towards technology supported instruction. Test results indicated that pre-test and post-test results were normal distributed for resistive behaviors ($p > .05$). Therefore, the t-test for dependent samples was applied to determine whether there was a statistically significant difference in the pre-test and post-test test scores in terms of resistive behaviors towards technology-supported instruction.

Qualitative data from prospective teachers in digital media were analyzed using inductive content analysis. Nvivo 8 program was used in this process. Before beginning to analyze the data, the researchers had examined and reread the data to make inference in general. Qualitative data were analyzed in four phases: Coding of the data, finding themes, organizing codes and themes, and describing and interpreting the data. After qualitative data analysis, all data were described under themes and codes. Models containing the themes, codes and their frequencies were produced using Nvivo 8. As a result, qualitative data were visualized and made more meaningful for readers.

Experts were asked to determine the codes that they agreed on and disagreed on. Then, the reliability of coding was proved by Miles and Huberman's reliability formula (1994) [$\text{Reliability} = \frac{\text{Agreement}}{\text{Agreement} + \text{Disagreement}}$]. Also, agreement score was found as 83.66%. The finding indicated reliability of the study based on Hubermann's statement (1994) that the research is reliable enough in case the reliability score is higher than 80%.

Reliability and Validity Studies

The exploratory and confirmatory factor analysis and reliability analysis findings proved the reliability and validity of the resistance scale to determine whether prospective teachers have resistive behaviors towards technology-supported instruction. Also, two researchers participated in the LEGO robotics instruction and the instructional process was recorded video. Strategies used in this research to provide internal validity for qualitative research design included external audits, rich explanations, and a set of evidence (Creswell, 2003). In addition, triangulation and semi-statistics were other strategies used to increase the internal validity of the study (Maxwell, 1996). In this sense, the preparation of measurement tools by experts, detailed description of study groups and instructional process, presenting findings together with quotations, using various data collection tools to explain the findings in detail, and quantification of qualitative data with Nvivo 8 program supports the internal validity of the study. In addition, the qualitative data were coded by three researcher and the calculated intercoded reliability are thought to prove the internal validity of the study.

RESULTS AND DISCUSSION

Findings from the Quantitative Data

The t-test results for dependent samples are presented in Table 1 to determine whether there is a statistically significant difference between pre-test and post-test mean scores for resistance towards technology-supported instructional.

Table 1. The Group's Pre-test and Post-test Scores for Resistive Behaviors towards Technology Supported Instruction: The t-Test Results for Dependent Samples

		n	\bar{X}	SD	df	t	p
Unwilling adaptation	Pre-test	18	12,61	3,61	17	2,538	.021
	Post-test	18	10,61	2,91			
Active resistance	Pre-test	18	11,72	2,29	17	.824	.411
	Post-test	18	10,94	2,89			
Complete adaptation	Pre-test	18	16,38	3,89	17	1.753	.098
	Post-test	18	13,88	5,23			
Disproving	Pre-test	18	5,50	2,70	17	.314	.757
	Post-test	18	5,77	3,40			
Disregarding	Pre-test	18	4,77	2,60216	17	.723	.480
	Post-test	18	4,27	2,82438			
Total Score	Pre-test	18	51	10,75	17	1.778	.093
	Post-test	18	45,50	13,94			

After viewing Table 1, there was no statistically significant difference between the pre-test and post-test scores for the resistance towards technology supported teaching ($t_{17}=1.778$; $p=.093$). In addition, there was no statistically significant difference between the pre-test and post-test scores for active resistance, full adaptation, disproving and disregarding dimensions of the scale. However, a statistically significant difference was found between pre-test and post-test scores for unwilling adaptation ($t_{17}=2.538$; $p=.021$). Pre-test score for unwilling adaptation was 12.61 with a standard deviation of 3.61; post test score was 10.61 with a standard deviation of 2.91.

According to findings, it can be understood that post-test scores for unwilling adaptation decreased compared to pre-test scores. Moreover, the calculated effect size score ($d=.60$) indicated that the difference was between medium and high level. In case, it can be considered that the prospective science teachers were more willingly involved in LEGO robotics instruction.

Findings from the Qualitative Data

Some of the prospective teachers' views, supporting that they had shown resistive behaviors towards technology supported instruction before designing LEGO robotics instructional practices, are presented below:

"To a certain extent, I complain about technology supported instruction. Teaching only with slides makes the course monotonous. So we can't learn." (P1)

"I become unhappy if slides are used to teach a lesson. I can't learn enough." (P2)

"To a certain extent, I complain about technology supported instruction. Teachers, using technological materials, don't take responsibility for teaching." (P4)

“To a certain extent, I accuse of teachers to integrate technology into instruction. Because there are some problems in the use of technology in class. Teachers’ continuous use of the similar technological materials makes the course monotonous.” (P6)

“I accuse of technology supported instruction. Because it takes too much time.” (P14)

Having designed LEGO robotics instructional practices, the prospective teachers were asked to explain whether they show such resistive behaviors as breaking down the lesson, sitting in the back row, not answering the questions and/or complaining about technology supported instruction, etc. Participants reported positive views on technology-supported instruction and added that they didn’t show any resistive behaviors. Some of the prospective teachers’ views supporting this finding are presented below:

“I don’t show resistance. I think technology supported instruction is necessary.” (P1)

“I didn’t show any resistance and suggest teachers not to use technology in the lessons until now. Because I like technology supported courses.” (P8)

“I don’t complain about technology supported instruction. In contrast, I think it is useful. If technology is used purposefully, it will be useful.” (P11)

“I don’t complain about it. In contrast to traditional instruction, technology supported instruction draws my attention and makes me researcher. Learning becomes permanent with the help of technology supported instruction.” (P14)

“When I attend the class I am excited for learning new information by means of technology supported instruction.” (P17)

“I think the courses become funny by means of technology supported instruction.” (P18)

The prospective teachers’ answers to the question, “How has the process of your robot programming affected your feelings and thoughts on technology supported instruction?” were examined under the themes of positive view and negative view. The themes and codes related to this question are presented in Figure 2.

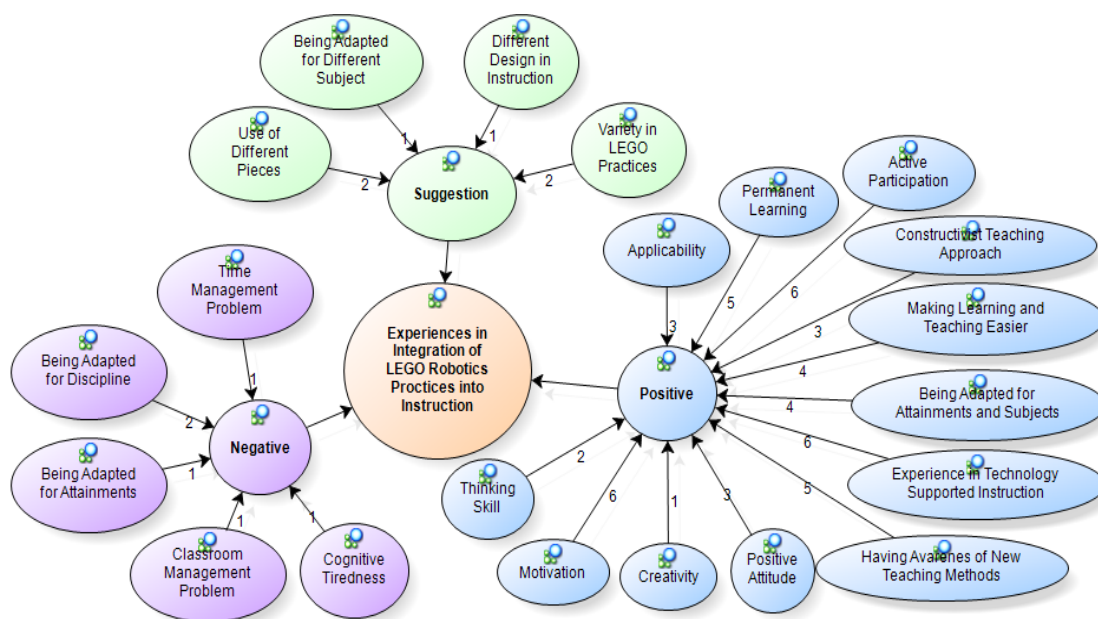


Figure 2. The participants’ feelings and thoughts on technology supported instruction

Upon examining Figure 2, it is observed that the prospective teachers had positive views on integration of LEGO robotics practices into science instruction. The prospective teachers' positive views on integration of LEGO robotics practices into science instruction are classified under the sub-themes of applicability (f=3), making learning and teaching easier (f=4), permanent learning (f=5), motivation (f=6), positive attitude (f=3), experience in technology supported instruction (f=6), thinking skill (f=2), creativity (f=1), being adapted for attainments and subjects (f=4), having awareness of new teaching methods (f=5), constructivist teaching approach (f=3) and active participation (f=6). Such codes as being adapted for discipline (f=2), being adapted for attainments (f=1), time management problem (f=1), cognitive tiredness (f=1) and classroom management problem (f=1) indicate the prospective teachers' negative views on the integration of LEGO robotics practices into instruction. Moreover, the prospective teachers' suggestions are classified under the sub-themes of the use of different pieces (f=2), variety in LEGO practices (f=2), different design of instruction (f=1), being adapted for different subjects (f=2). Some prospective teachers' views supporting this finding are presented below:

"LEGO robotics practices are usable in Physics. These practices will be new approaches in education and make learning easier." (P1)

"LEGO robotics practices will provide to get rid of traditional education approach and to think from a different viewpoint." (P3)

"LEGO robotics practices caused permanent learning and made the students curious. They motivated the students." (P6)

"LEGO robotics practices caused to examine the subjects in detail. They contributed to our thinking skills." (P7)

"LEGO robotics practices are effective instructional applications to take the students attention. The students can learn by doing on their own with the help of these practices." (P10)

"LEGO robotics instructional practices support curriculum based on constructivism. The students become active by means of LEGO robotics practices." (P11)

The prospective teachers' views on their experiences in integration of LEGO robotics practices into instruction were examined under the themes of positive view, negative view and suggestion. The themes and codes related to this question are presented in Figure 3.

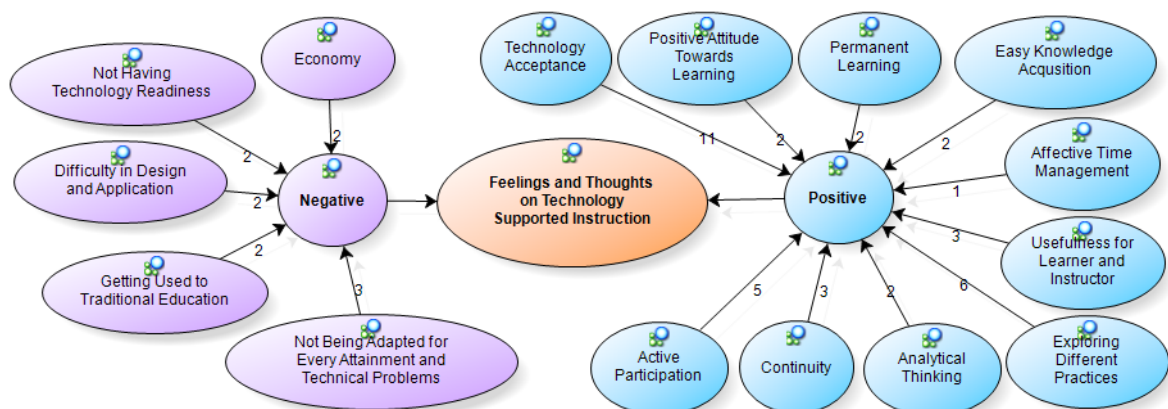


Figure 3. The participants' experiences in integration of LEGO robotics practices into instruction

The prospective teachers' views on the effects of programming robot on their feelings and thoughts on technology supported instruction are classified through the sub-themes of technology acceptance (f=11), positive attitude towards learning (f=2), permanent learning (f=2), easy knowledge acquisition (f=2), affective time management (f=1), usefulness for learner and instructor (f=3), exploring different practices (f=6), analytical thinking (f=2), active participation (f=5) and continuity (f=3) under the theme of positive view. The prospective teachers' negative views are classified through the sub-themes of economy (f=2), not having technology readiness (f=2), difficulty in design and application (f=2), getting used to traditional education (f=2), not being adapted for every attainment and technical problems (f=3). Some prospective teachers' views, supporting the codes above, are presented below:

"Upon having considered how technology was used in instruction I understood that only internet and computer weren't technologies used in a class. In addition, I accepted that LEGO robotics products were effective technologies making a lesson more understandable and entertaining." (P2)

"I think technology supported instruction should be continuous. It is useful and provides convenience for both instructors and learners." (P4)

"Technology supported instruction is significant factor in education. I think that technology use in science education affects the students' reading comprehension skill positively." (P12)

"I accept the necessity of technology supported instruction. Because it provides students to learn much more knowledge in a short time. Technology supported instruction made me to think more analytically and analyze the conditions from a different viewpoint. I believe that if I use such technologies for instruction, these technologies will attract the students' attention and make them motivated." (P14)

The reasons why the prospective teachers will integrate LEGO robotics practices into instruction are classified under the themes of being a new teaching method (f=3), learners' positive attitudes (f=4), taking students' attention (f=5), constructivist teaching (f=3), popularity of robotics practices (f=4), permanent learning (f=7), objectifying the content (f=5), developing the learners' skills (generating project, innovative thinking, problem solving, creativity, etc.) (f=3) and being adapted for science education (f=3). Some prospective teachers' views supporting this finding are presented below:

"I want to design LEGO robotics practices in order to take the students' attention, motivate them, objectify the abstract knowledge, provide permanent learning and train the students having such skills as creating projects, generating innovative ideas, solving problems, etc."(P7)

"The reason why I will use them in my courses in the future is to make the students motivated and take their attention." (P10)

"I want to use them because of usability of them in science education." (P11)

The participants were asked to generate metaphors relating to "LEGO robotics instructional practices" and "technology supported instruction". The results of metaphor analysis are presented in Figure 4.

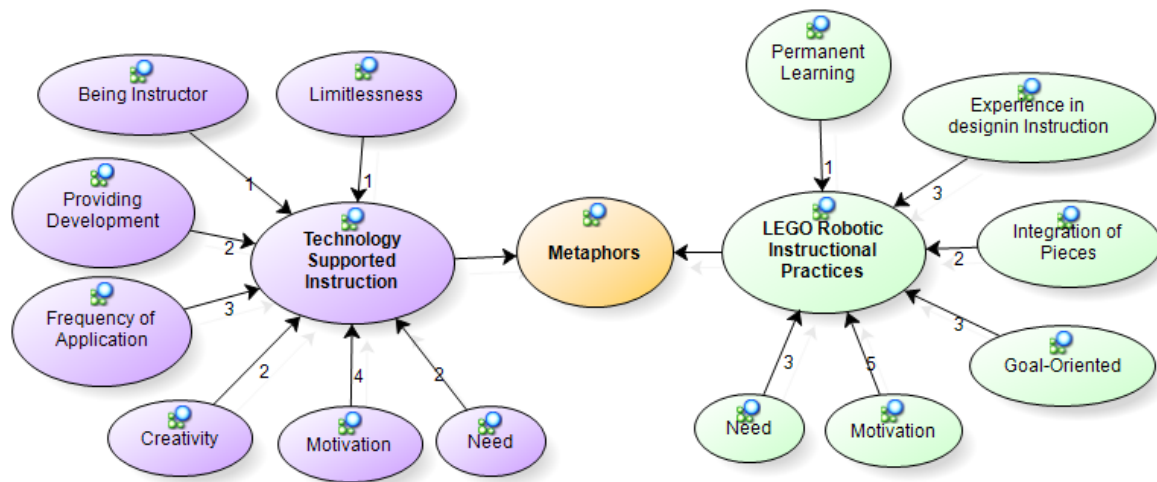


Figure 4. Thematic presentation of the metaphors

The metaphors on LEGO robotics instructional practices are classified under the sub-themes of need ($f=3$), integration of pieces ($f=2$), goal-oriented ($f=3$), motivation ($f=5$), experience in designing instruction ($f=3$) and permanent learning ($f=1$). Some metaphors are flower, puzzle, system, designing cartoon, educational material. The metaphors on technology supported instruction are classified under the subthemes of need ($f=2$), limitlessness ($f=1$), frequency of application ($f=3$), motivation ($f=4$), providing development ($f=2$), creativity ($f=2$) and being instructor ($f=1$). Some generated metaphors are water, medicine, book, drawing picture, puzzle, educational play, ocean. The generated metaphors indicate that the prospective teachers have positive views on LEGO robotics instructional practices and technology supported instruction.

DISCUSSION AND CONCLUSION

In the study it was observed that the participation in LEGO robotics instructional practices had caused a decrease in the prospective teachers' post-test scores for unwilling adaptation, one of the dimensions of resistance scale. That is to say, statistically significant difference between the pre and post test scores for unwilling adaptation was observed. This infers that the prospective science teachers participated in technology supported instruction more willingly after having experienced in LEGO robotics instructional practices. This also implies that designing process of LEGO robotics instructional practices affects their resistive behaviors towards technology supported instruction. Also, the prospective teachers' resistance towards technology supported instruction before designing LEGO robotics instructional practices was proven by the qualitative data. It was found that before designing LEGO robotics instructional practices the prospective teachers had shown resistive behaviors such as complaining, breaking down a lesson, participating in a lesson unwillingly, accusing of the instructor, etc. However, it was concluded that the prospective science teachers had positive views on technology supported instruction and didn't show resistance towards technology supported instruction after having designed a robot and participated in LEGO robotics instructional practices. Ertmer (2005) stated the difficulty of turning teachers' negative views on technology integration into positive ones. Moreover, Ertmer (2005) emphasized that personal experiences shape individuals' views on technology integration. Yavuz Konokman (2015) added that the prospective teachers' perceptions of technology integration turned into positive and their resistive behaviors towards technology supported instruction disappeared after having prepared a digital story and integrated digital stories into instruction. In parallel with Ertmer's and Yavuz-Konokman's opinions, giving chance to the prospective teachers to have experience in designing LEGO robotics practices and integrating them into

instruction can lead to changes in individuals' resistive behaviors toward technology supported instruction. Moreover, Kucuk and Sisman (2017) stated that LEGO practices took the students' attention on a course and motivated them. In literature other studies present similar results (Alimisis 2013; Ortiz 2015). Therefore, it can be inferred that participating in the course designed with the help of instructional technologies such as LEGO robotics affects the prospective teachers' resistance towards technology supported instruction and their perceptions of course.

It was concluded that the process of robot programming affected the prospective teachers' perception of technology supported instruction. Exploration of the advantages of technology supported instruction (permanent learning, analytical thinking skill, easy knowledge acquisition, active participation, etc.) indicates the prospective teachers' positive perception of technology supported instruction. Similarly, Yavuz Konokman (2015) added that the experimental group observed that the use of technology for teaching motivates students, makes their learning easier, and allows them to be more participatory in activities. Moreover, some studies in literature showed that LEGO robotics instruction makes learners to participate in activities actively and supports constructivism in education (Chambers et al. 2008; Ozdogru 2013; Goh and Ali 2014; Kazez and Genc 2016). In parallel with the results of the studies in literature, LEGO robotics instructional practices can lead to changes in the prospective teachers' perceptions of technology supported instruction and their resistive behaviors.

Teaching science with the help of LEGO robotics instructional practices was thought to be effective by the prospective science teachers. This finding is supported with the prospective teachers' views that LEGO robotics practices objectify the content, can be adapted for science, encourage permanent learning and make students have positive attitudes towards science. Moreover, the advantages of LEGO robotics instruction such as group working (Aufderheide et al. 2012), problem solving (Castledine and Chalmers 2011), learning by trial and error (Somyurek 2015) indicate that science can be thought by means of LEGO robotics activities because LEGO robotics activities function the goals of science curriculum. Ozdogru (2013) also emphasized that LEGO robotics instruction is offered in science education. Moreover, Cukurbasi and Kiyici (2017) stated that LEGO robotics activities are designed functionally for each education level. In parallel with the results of these studies, it is inferred that LEGO robotics products are instructional technologies, usable in science education.

It was observed that the prospective teachers had positive views on technology supported instruction after their experiences in integrating LEGO robotics activities into science education. This finding is supported by the prospective teachers' positive views that LEGO robotics activities in science education make learning and teaching easier, provide permanent learning and active participation, motivate the students and develop their thinking skills and creativity. The reasons why LEGO robotics activities are used for educational purpose were stated to be a new teaching method, take the learners' attention, objectify the content, develop the learners' skills (generating project, innovative thinking, problem solving, creativity, etc.), make permanent and active learning, be adapted for attainments of science curriculum. The prospective science teachers' positive views on the use of LEGO robotics activities for educational purpose in this study indicate that the prospective teachers will prefer to design LEGO robotics instruction and will give importance to technology supported instruction in their professional life. Moreover, the metaphors on LEGO robotics instructional practices are classified under the categories of need, integration of pieces, goal-oriented, motivation, experience in designing instruction and permanent learning. This implies that LEGO robotics instruction motivate the students and make them to learn permanently. Moreover, that the prospective teachers had chance to design LEGO robotics instruction is thought to enable them to have experiences in designing technology based learning environments. This means that the prospective science teachers have positive perception of LEGO robotics instruction and technology supported instruction.

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Compliance with ethical standards

Conflict of interest: The authors declare that there are no conflicts of interest associated with this paper.

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