

THE EFFECT OF LEGO EDUCATION ON STUDENTS' SOCIAL AND PROBLEM-SOLVING SKILLS

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Abstract

Educating children is mainly aimed at fully developing their characters as well as superior values. Therefore, the need for novel pedagogical technologies to enhance students' problem-solving abilities in the context of social interactions is strongly felt more than ever before. The present study sought to evaluate the effect of LEGO education technology on social skills and problem-solving abilities among 11-year-old students in a Tehran province. For this purpose, in a quasi-experimental study, with a pre-test and post-test design, the number of 25 students (13 female and 12 male students) were selected via a representative sampling method from all schools in the province of Tehran province who received LEGO Education, and its social component skills which include the subscale of cooperation, decisiveness, and restraint; these components were measured using the Gresham and Elliott Master's Skill Assessment Scale, while the problem-solving in this study was assessed using the Heppner-Patterson test, which includes three subscales of personal control, attachment-avoidance, and feeling of being adequately measured. The findings demonstrated that students' social skills and problem-solving skills increased significantly in the post-test. It was concluded that LEGO education technology had a positive effect on its social skills and its subscales, as well as its problem solving and subscales.

Keywords: LEGO Education Technology, Social Skills, Problem-Solving Abilities, Children.

The Effect of LEGO Education on Students' Social and Problem-Solving Skills

Large-scale developments in science and the fast pace of technology have affected various dimensions of human life, causing complicated environments and a variety of needs; thus, there is a need for more constructive measures in life to solve human's individual and social problems at the same time (Hosseinimehr et al., 2019). As a result, scholars and authorities in education around the world have developed ways to improve children's social skills and problem-solving abilities, so that they can meet the challenges people encounter every day in their

lives (Akbari, 2015; Kryukova, E. M., et. al., 2021; Mirza, E. A., et. al., 2019).

In recent years, parents, educators, and the community have concluded that one of the main objectives for children at younger ages is to turn them into independent and socially skilled citizens to meet their personal and professional goals during adulthood (Greenberg et al., 2003). Social skills are observable and measurable conducts that help improve independence, acceptance, and desirable quality of a life, as they greatly contribute to the development of children to solve their problems in daily lives. However, it should be pointed out that the development of

these skills in children does not take place similarly (Gresham, 2002).

As research data suggest, children with appropriate social skills, as compared to children lacking these skills, are more likely to be successful in establishing effective relationships with their peers (Asher & Taylor, 2001) and learning different material in an educational environment as well as academic achievement (McClelland et al., 2000); as a result, systematic promotion and appraisal of children's socio-emotional skills as well as communities and school development and well-being have received much consideration in recent two decades (Humphrey, 2013;).

One of the ways to improve children's ability and skills is play education ; playing is a child's need, and in group games, children, like active learners, begin to learn social skills through a series of modeling, practices, performance, feedback, reinforcement, and generalization (Bandura, 1977a), which increase empathy, social orientation, moral behaviors, self-control, self-esteem, compliance, assertiveness, lawfulness, the tendency to participation and generally social skills in pre-school ages (Aghajani, 2011; Nicolopoulou et al., 2015; Rashidi et al., 2010; Yazdanipour & Izadkhasti, 2012).

On the other hand, one of the skills that help children better develop is increasing their problem-solving skills, which John Dewey believes the condition for human life continuity is the interaction with the environment, arguing that the individual encounters challenging, ambiguous, and uncertain situations in life which interfere with his/her ongoing experiences; this leads the individual to acquire a new experience through which knowledge is acquired in the interactions with the environment. Over time, any occurrence that increases our experience as a result of encountering an ambiguous situation encourages us to constantly examine our experiences to solve current problems through cues we have gained (Guteg, 2002). Thus, one of the major learning and socialization skills is problem-solving skills, which means developing learners' appropriate thinking habits, creating desirable conditions for thinking, reinforcement, encouragement, and guiding learners to acquire socially accepted thinking skills as thinking and encouragement in the education and learning process are inevitable. If the Education System fails to provide learners

with problem-solving and pedagogical methods, it could derail the community' success, because problem-solving is a cognitive-behavioral process used by the individual to explore adaptable solutions (Nezu et al., 2002) to deal with life problems (Perla & Donnel, 2004).

Studies have indicated that educating problem-solving strategies can bring about positive and enduring changes for peoples' social behaviors (O'Reilly & Chadsey-Rush, 1992). The important point is that finding a specific goal in a modern education process for a specific challenge is not intended; rather the aim is to have a principle used for problem-solving while being generalizable to other situations (Khoshkam et al., 2008); therefore, training methods which introduce problem-solving as a supporting social program can reduce risky effects and help the child better gain social sufficiency; thus, it is very critical to develop such skills in children. Hence, the learning process should provide thinking ability in learners because it can help them better cope with problems instead of obliging them to memorize material. This helps them face the real scenes and challenges ahead to understand the situation and deal with them. Problem-solving-led learning is a kind of deep and active learning which prepares the individual to effectively deal with real-life experiences. Considering the students who lack problem-solving abilities and may feel frustrated when coping with life situations (Shure, 2000); it is imperative to develop educational programs to promote problem-solving skills under social situations and to increase students' adaptability levels.

Game-based learning allows students to engage in targeted activities that would simulate the experiences they will face in everyday life as they are generally defined by four characteristics; they are usually voluntarily and intrinsically motivational, i.e., they are enjoyable by themselves not relying on external stimuli; the games involve some levels of activities which require physical engagement and are distinguished from other conducts as they instill a sense of belief in children; each of these characteristics paves the way for reinforcing meta-cognitive skills and creating individual independence; thus resulting in a common relationship among the peers which increase collective development among the students (Rieber, 1998; quoted by Erah, 2018).

Considering the available educational tools in the world, LEGO education is a game-based learning instrument to address students' social skills and

problem-solving. Put it simply, LEGO Education is based on a hands-on learning approach that actively involves students in their learning process. LEGO students use LEGO bricks and digital tools to solve problems creatively and to excel at working with others and thinking critically. Here, three main theories are raised which include Process Theory, Vygotsky's Social Constructivism, and the concept of Scaffolding to support the Mind and Hand Relation Theory in students.

According to the first theory, i.e., process theory, education is most effective when the student is engaged in simple and complex activities proportionate to his/her abilities, as this may engender arousal and motivation without anxiety. Under such situations, the individual facing challenges should be assisted via clear guidelines; this theory is highly associated with the development-point theory stating students should engage in the activity being slightly higher than their abilities and the activity compatible with their skills.

Once students arrive at the Process Stage when they are challenged correctly, and they leave this stage when they are over-challenged, as leaving this situation and returning to it will provide the best situation for educational conditions.

Upon observing the members of the LEGO education classes, the facilitator will first seek to understand the education process and students' individual movement experiences, appraise their predominant personal interests and learning styles, thus proposing proportionate challenges. Besides, s/he specifies the clear, accessible objectives commensurate with their problem-solving skills and begins to create motivation for success in them (Primus & Sonnenburg, 2018).

According to the second theory, Gauntlett (2011) suggests that thinking and construction make up similar facets of a process while developing various models using LEGO bricks help represent children's ideas and learning to express their opinions, establish communications with others and deal with problems. This theory is in line with the Knowledge Creation theory through the process of the subjective-physical model involving some aspects of Vygotsky's Social Constructivism and the concept of Scaffolding. According to this concept, the interplay between the actual development level determined by problem-solving skills and the potential

development level determined using the problem-solving process is directed by adults and assisted by peers (Vygotsky, 1978).

In LEGO education classes, the LEGO tool requires the instructor as a facilitator to effectively interact with students; accordingly, the facilitator first tries to create an actively dynamic environment to encourage the students to not only start other positive interactions with each other, but also to continue it, which greatly contributes to developing such skills as problem-solving, decision making, self-management, and relationships with peers (Seven & Yoldas, 2007; Van Squik, 2008, quoting Idogan et al., 2009).

After matching students' levels of knowledge with each other in the class, the facilitator then uses LEGO bricks to express the existing issue both individually and collectively. Interaction with friends and cooperation with classmates to create LEGO bricks provides an opportunity for students to not only improve their social and teamwork skills (Bulmer & Herbert, 2011; Subhi, 2009) but also to support each other to materialize potential development to solve the existing problems in the classroom.

To Walker (2004), the fundamental principle of this type of learning environment is that "we are together and help each other become successful". In the collaborative learning construct, students usually collaborate in a small group to strengthen the group work; this means that to achieve internal reinforcement, the members with higher abilities should work together with those with lower abilities, as this may empower students with high ability to assist the ones with lower ability.

Also, according to the third theory, LEGO educational classes provide students with the ability to demonstrate their learning through simultaneous brain-hand coordination, as they face a new world which causes the brain to better analyze the situation; something we lack in the traditional education process (Nasr Abadi et al., 2005).

Because previous research has not addressed the effect of LEGO education on social skills (Fachantidis et al., 2019; Lindsay et al., 2017; Narzisi, 2021; Radley et al., 2020; Yalamanchili, 2015), the present study sought to determine the effect of LEGO education on increasing the social skills of normal children. Moreover, Sharifi Asl and Asadian (2015) investigated the effect of LEGO education as a tool to improve students' problem-solving skills in Textbook "Sciences"; however, he did not measure the effect of LEGO education as regards children's problem-solving

skills in solving everyday problems, better compatibility and the ability to effectively communicate with others. Thus, the present study aimed to measure the effect of LEGO education on social skills and problem-solving among 11-year-old children, so that it is regarded by parents, instructors, and facilitators as a step towards students' empowerment and skill-learning.

Method

The present study used a quasi-experimental method of pre-test and post-test design. To do this, 25 eleven-year-old elementary school students were selected via available sampling from a statistical population of the study consisting of all 11-year-old children (amounting to 1000 people) taught through LEGO education classes in Tehran from 2016-2017. The table below lists the frequency of their gender.

According to Table 1, boys account for 48% of the sample while girls account for 52%.

Table 1.
Frequency of gender

Variable	Frequency	Percentage	Cumulative percentage
Boys	12	48	48
Girls	13	52	100
Total	25	100	

Measurement Tool

Two tests were used in this study to investigate the effect of LEGO education on 11-year-old students' social skills and problem-solving. Social Skills Rating Scale was used to evaluate the level of social skills (Gresham & Elliott, 1989), including three subscales of cooperation, decisiveness, and restraint. In the meantime, Heppner's Problem-Solving Inventory Test was used to measure students' ability to solve problems (Heppner & Petersen, 1982), with three subscales of problem-solving confidence (PSC), avoidance-attachment (AA) style, and personal control (PC).

Social Skills Rating System: SSRS Secondary Level Questionnaire-Teacher Form (SSRS)

Shahim (1999a) reported the reliability coefficients of the Social Skills scale of the Instructor's Form on a group of mentally retarded children to be 0.77 and 0.99, while reporting coefficients of 0.49 and 0.96 on a group of normal children using Parents and Teachers Form (Shahim, 1998, 1999b, 1999c). Investigating the reliability coefficients of the instructor form, the coefficients for social skills scales were reported to be 0.76 and 0.78 for girls and 0.75 and 0.24 for boys, respectively.

According to findings by Gresham and Elliott (1990), this scale was structurally valid and concurrently fit, whose diagnostic and therapeutic use for children was confirmed in several studies (Elliott et al., 1989; Fantuzzo et

al., 1998). Internal consistency and retesting were reported to be desirable as indicators of scale structural validity (Shahim, 1999a). The retest validity of the social skills factor was 0.85, of problematic behaviors 0.84 and of the academic adequacy factor 0.93, while the internal consistency of social skills was 0.94, of the problematic behaviors 0.88, and the academic adequacy 0.95 (Gresham & Elliott, 1990).

Heppner's Problem-Solving Inventory (PSI)

This scale was developed and tested using several samples of subjects which demonstrated relatively high internal consistency with alpha values reported to be 0.72 and 0.85; the alpha value for the subscale of personal control was 0.72, attachment-avoidance style 0.84 and problem-solving confidence 0.85 and the overall scale 0.90 (Heppner & Petersen, 1982, pp. 75-66). Test validity suggested that the instrument measures a construct that pertains to personality and control variables (Heppner & Petersen, 1982, pp. 75-66). Test reliability of the total inventory score was reported to be in a range of 0.83 to 0.89 in a two-week interval, indicating that the Heppner's Problem-Solving Inventory is a reliable tool for measuring problem-solving ability.

This scale was translated by Raf'ati and supervised by Khosravi in 1996 and used in Iran for the first time (Khosravi et al., 1999, pp. 35-45). Cronbach's alpha value obtained in the Khosravi et al. (1999) research was 0.86 while in Bazli's research (2004), it was 0.66 which was acceptable.

Also, Rastgoo et al.'s research (2010) reported the reliability of this scale to be 0.83 and 0.89 within a two-week interval.

The factors were found to have good and acceptable internal consistency as the alpha coefficient of problem-solving confidence was 0.85, attachment-avoiding style 0.84, and emotions controlling behavior 0.72. The alpha coefficient was 0.80 for problem-solving confidence, 0.78 for attachment-avoiding style problem-solving activities, and 0.70 for controlling emotions and behavior during problem-solving.

HUSO LEGO Education Package

It includes three educational levels involving courses on social skills, writing, and storytelling, as well as elementary math education.

The "build to express" package constructs abstract concepts to strengthen social skills, verbal creativity, critical thinking, and effective dialogue. This package applies to social classes and development activities.

The "storystarter" package uses stories to teach literature, train storytelling, verbal skills, reading, and writing skills, develop imagination and comprehension. This package can be used in Persian literature, composition, English, and social science classes in elementary schools.

The "more to math" package makes use of engagement activities and modeling processes to help understand mathematical problems, solve problems, thus, strengthening the power

of reasoning, and training basic mathematical concepts. This package is applicable in elementary math classes.

Procedure

Both tests were first used before the independent variable was specified as the pre-test in the sample group and as a post-test after being implemented. The sample group received a LEGO education package called See and Construct on different courses such as humanities, social skills, development of abstract concepts to strengthen social skills, verbal creativity, critical thinking, and effective dialogues among students for 12 sessions in four weeks, three days a week and one and a half hour per day.

RESULTS

The findings of the present study are illustrated in Tables 2 which show the descriptive indicators of pre-test and post-test research variables.

Given descriptive data, after LEGO education courses are held, students' social skills and problem-solving skills were strengthened. Then, we deal with the inferential hypotheses.

Considering the tests performed, one would conclude that using LEGO technology could significantly increase the eleven-year-old students' social and problem-solving skills; also, given the mean Gresham and Elliot's tests results, using LEGO education was found to increase social and problem-solving abilities among the students.

Table 2
Descriptive indicators of research variables in pre-test and post-test

Variable	Test	Mean	Standard deviation	No.
Social skills	Pretest	56.44	4.292	25
	Posttest	76.44	4.647	25
Collaboration	Pretest	20.88	2.315	25
	Posttest	20.66	2.121	25
Decisiveness	Pretest	19.20	1.871	25
	Posttest	26.52	2.084	25
Assertiveness	Pretest	16.36	1.381	25
	Posttest	23.32	1.492	25
Problem-solving-	Pretest	140.80	11.673	25
	Posttest	168.64	5.780	25
Feeling sufficiency	Pretest	51.12	5.199	25
	Posttest	59.92	2.253	25
Self-restraint	Pretest	20.64	3.108	25
	Posttest	24.80	2.398	25
	Pretest	69.04	5.070	25

Attachment-avoidance style	Posttest	83.92	3.290	25
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DISCUSSION

As the results of the tests indicated, it is concluded that applying LEGO educational tools had a significant positive effect on the social skills of 11-year-old students and the three subscales of collaboration, assertiveness, and self-restraint. The obtained findings are consistent with those of researches by Akbari and Rajab Blokati (2017); Yanhu (2010); Legoff (2004); LeGoff and Sherman (2006); Hossein et al. (2006); Baron et al. (2008); and Tazkereh Tavassoli (2010).

To explain this issue, one would say that just as Streyer (1989) considered social skills as the child's reciprocal adaptation to the social environment, his/her friends, and establishment of a positive relationship with peers, LEGO education classes provide an appropriate setting for the child to cooperate with others in it and actively engage in group activities to deal with the problems; this will also help them better solve the problems that arise for them as they grow.

In the meantime, the child with higher social skills not only establishes positive and useful relationships but also can maintain, continue and expand these intimate relationships with other peers and adults. Children meet this goal through acceptable, targeted, and interrelated verbal and nonverbal behaviors (Kolb et al., 2003). Since children implicitly learn in LEGO education classes how to play with LEGO pieces and solve problems within the process of building their structures, they need to engage in positive relationships with the facilitator and their peers during such classes to maintain partnership and collaboration.

Moreover, since these classes were collective and involved teamwork, students became more empowered and could help their peers develop both directly and indirectly. Every time children experienced positive verbal and non-verbal behaviors, they had their confidence soar, thus generalizing these relations to other aspects of their lives.

Also, as the results suggested, it can be stated that LEGO education had a positive effect on cooperation among 11-year-old students, which the findings were found to be consistent with those of researches by Legoff (2004); Lee Goff

and Sherman (2006); and Hussein et al. (2006). Broadly speaking, it is suggested that Kartelj and Milburn (1985) reaffirm in their classifications of different social skills that the necessary condition for the child to adapt to the social environment and perceive his/her peers is to be made aware of his/her feelings about him/herself and others. When the child understands his/her feelings and those of others, s/he can sympathize with them. In the LEGO class process, the most fundamental instruction provided by facilitators is to familiarize children with their own and others' feelings as commensurate with their age and age-appropriate tools (Gauntlett, 2011). Lewis and Mikseon (1983) posit that perceiving the feelings of others requires sympathy which includes a clear response to one's emotions about others, as a result, the child learns to express his/her tastes and emotions without anxiety (Lance Berry et al., 2003; Radsep, 2005).

As regards the effect of LEGO education on children's decisiveness, the results suggested that LEGO education had had a positive effect on 11-year-old students' decisiveness. The findings were consistent with studies by Hossein et al. (2006); Baron et al. (2008) and Tazkereh Tavassoli (2010). To explain this, Radsep (2005) argues that the individual with higher social skills must be decisive to preserve self-esteem and enjoy the ability to say no to the demands put forward to him/her. In LEGO classes, students learn how to analyze LEGO constructs, to express their ideas appropriately and honestly without infringing on other rights; they always learn to shoulder responsibility for their ideas, feelings, and behaviors.

Speaking of the last subscale of social skills, LEGO education is said to have a positive effect on the 11-year-old students' self-restraint. The findings of this study were consistent with those of Strat (2010); and Yanhu (2010). To interpret this, Goleman argues that because emotions are undeniable parts of the individual's cognitive world, they cannot be thrown away; they must manage them properly. People who can prioritize realistic goals and establish a balance between emotions and reason when making decisions enjoy self-restraint, which refers to the extent to which a child's behaviors adapt to the existing situation and the extent to which a person can feel

resilience and stability in his/her situation (Kaushal & Kwantes, 2006).

Generally speaking, three subscales of social skills include cooperation, decisiveness, and self-restraint, which are mutually dependent in a way the child with higher social skills must be decisive to preserve his/her self-esteem properly and without anxiety. In LEGO classes, students learn how to analyze LEGO constructs, to express their ideas appropriately and honestly without infringing on other rights; they always learn to shoulder responsibility for their ideas, feelings, and behaviors. Students need to cooperate with their peers, which requires them to have self-control over their behavior; i.e., they need to have the ability to delay satisfying their demands within an accepted or social framework and exert self-restraint over internal and external processes; this leads them to avoid aggression and aggressive behaviors (Baker, 2004). Social skills should be explicitly taught to children and in a step-by-step process through modeling, with education materials conveyed to a real social situation (Bandura, 1977b).

To answer the second question of this study on how LEGO education affects the problem-solving skills among 11-year-old students enjoying three subscales of problem-solving confidence, avoidance-attachment style, and personal restraint, it is indicated that this finding was in line with researches by Hussein et al. (2006), LeGoff and Sherman (2006), Hussein et al. (2006). To explain this, one would argue that students in LEGO education classes learn how to produce a proper definition of themselves in each session; thus, solving their problems along with their peers. LEGO Education was also found to affect children's restraint, as this finding was in line with research findings by Hussein et al. (2006). To explain this, one would argue that the child, while accompanying his/her peers, develops self-management skills and can freely and without fear of judgment create his/her constructs in a safe environment which in turn increases the child's self-confidence and tendency to solve new problems.

Besides, as regards the positive impacts of LEGO education on students' attachment and avoidance, this finding was in line with the research findings by Hussein et al. (2006). To explain this, one would argue that according to the constructivist theory which recommends education based on active learning and teaching processes to create a novel way of solving a new problem, LEGO also provides an open system

with tools commensurate with the age group of the child, where the instructor serves as a facilitator aiming to direct students. LEGO education seeks to pay attention to all aspects of constructing and analyzing its structure, with the instructor encouraging the students to look differently as s/he raises targeted questions to create communications with them. It is thus concluded that LEGO education courses apply LEGO tools, help increase divergent thinking while proposing lesson plans for all academic ages. LEGO games help develop social and problem-solving skills among 11-year-old students. Expression of ideas and feelings using LEGO and practicing life skills through raising ideas and active listening could help increase children's problem-solving ability; this helps them create their mental frameworks in a happy setting to express their feelings and ideas without fear of judgment; this is because today, time management is the integral part of social skills and the ability to solve problems is the key to effective communication. Because children represent the behavior of their surroundings, they can be developed in educational environments to help them develop their social skills and strengthen their problem-solving ability, as it may lead to a better life situation.

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