



## A STUDY ON THE RELATIONSHIP BETWEEN PROBLEM SOLVING SKILLS AND MULTIPLE INTELLIGENCES OF HIGH SCHOOL STUDENTS

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### ABSTRACT

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Problem solving is a complex process in which encountered problems are defeated as reaching a target and problem solving skills are developed in school years. And, intelligence is defined as the ability to solve problems or to create products being valued within one or more cultural settings. Therefore, the purpose of the present study is to examine the relationship between multiple intelligences and problem solving skills. The relational model was used in the current study. The research group included 181 female (48.39 %) and 193 male (51.61 %) students studying at Zubeyde Hanim Vocational and Technical Anatolian High School and Gazi Industrial Vocational High School. The Multiple Intelligences Inventory adapted in Turkish by Ozden (2003) and Problem Solving Inventory developed by Heppner and Peterson (1982) and adapted in Turkish by Sahin *et al.* (1993) were used as the data collection tool. Data were analyzed using the analysis of Pearson correlation. The findings indicated that there have been found some significant positive and negative correlations between variables.

**Contribution/Originality:** This study contributes to the existing literature by investigating the relationship between high school students' problem solving skills and multiple intelligences.

## 1. INTRODUCTION

Education is an active process which is the necessity for the individual to access to knowledge easily, and to have critical thinking skills (Saracaloglu *et al.*, 2009). Altun (2003) suggests the aim should help learners to attain and develop the knowledge, skills and attitudes for her/him to overcome the problems she/he faces with the scope of the active education process. And, Gok and Erdogan (2011) underline this makes bringing up creative individuals who can think critically and solve problems. They also believe it is the most important duty of the educational institutions. There are also many studies and developments which have resulted in significant changes in perspectives concerning intelligence. According to Gardner (1983) individuals have many intelligence areas, and some of them have more developed areas. He states people have the different ways of thinking. And, it is underlined they cannot be successful in solving the problems, if they do not recognize their own different components of intelligence.

## 2. LITERATURE REVIEW

### 2.1. Problem, Problem Solving, and Problem Solving Skills

Problem is described as an obstacle against available difficulties gathered by a person in order to reach her/his aim (Bingham, 1983). It is also defined as the difference between the available and expected situation of something (Keeneland, 1999). Ustun and Bozkurt (2003) state that a person lives get meaning with the solution of these problems, since she/he faces many problems continuously. And, Heppner *et al.* (2004) highlight it is difficult to separate problems and life owing to these reasons.

Problem solving is defined in many ways. For example, according to Gagne (1970) it is the highest level of learning from the problem solving skill as the unavoidable life skill. It is also expressed as a thinking process, where individuals discover the composition of previously principles which they have learned to solve a problem (Gagne, 1977). Moreover, it is defined as the result of the implementation of certain knowledge to understand a problem (Ashmore *et al.*, 1979) and as a scientific research task (Perez and Torregrosa, 1983). Bingham (1998) also states that problem solving is a process which requires a set of targets that relate to moving some obstacle to reach an exact target. It is defined by Morgan (1995) as a process which one feels the problem as finding a solution to it. Problem solving is explained as coping with the problem by Heppner and Krauskopf (1987).

Guclu (2003) interprets problem solving skill as a skill that a person has to be an individual, getting along with her/his environment, living a healthy life and protect her/his mental health. And, it is underlined higher order thinking skills such as visualization, association, abstraction, comprehension, manipulation, reasoning, analysis, synthesis, and generalization are involved in problem solving. In our days, there is a strong movement in education to integrate problem solving as a main component of the curriculum (Kirkley, 2003).

There are many researches on problem solving skills of the individuals at different age groups and several educational levels. It is found out there is not a significant relationship between gender and university students' problem solving skills in his study in which he examined the relationship between the individual properties of university students and their problem solving skills (Dundar, 2009). Also, Forgatch (1989) concludes the level of the students effects their problem solving skills. Taylan (1990) study shows while there is a meaningful difference according to the curriculum, there is not a significant relationship between the students' problem solving skills and their genders, department, and class levels. Aylar and Aksin (2011) realizes that there is not a significant difference between the Social Sciences Teaching students' graduated high school, grade and problem solving skills. However vocational high schools students' and university students' problem solving skills have received considerable concern from employers to the public at large, many researchers such as (Nickerson, 1994; Woods *et al.*, 1997) state that they are not acquiring this skill.

### 2.2. Intelligence and Multiple Intelligences Theory (MIT)

Intelligence is defined in various different ways by many researchers. For example, Binet and Simon (1905) define it as judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances. Also, according to Ozguven (1961) it is an ability to learn. And, of course, most of these explanations include a focus on academic learning, and measured intelligence from the school success. And, various aspects of intelligence have been discovered by many psychologists and educational experts such as Piaget and Thorndike. Piaget describes intelligence as a process of adaptation (McLeod, 2009) and the changes and innovations of the conscious mind. On the other hand, Thorndike defines it is three dimensional: abstract, mechanical, and social intelligence (Selcuk *et al.*, 2003).

After their various studies, Howard Gardner who is a learning specialist and his colleagues identify eight intelligences and afterwards adding another have theorized the multiple intelligence theory. These are linguistic, logical-mathematical, visual spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalist, and existential intelligence (Armstrong, 2001; Yavuz, 2004; Fogarty and Stoehr, 2008). Linguistic intelligence including

such skills as the abilities to remember information, to convince others to help you is the ability to use words effectively both orally and in writing. Logical-mathematical intelligence which covers such skills as understanding the basic properties of numbers and principles of cause and effect is the ability to use numbers effectively and reason well. Visual spatial intelligence which includes the ability to graphically represent visual or spatial ideas is the ability to perceive visual-spatial world. Bodily-kinesthetic intelligence including such physical skills as speed, coordination, and flexibility is the ability to use the body to express ideas and feelings and to solving problems. Musical intelligence which covers such skills as the ability to perceive and produce the different musical formats is the ability to sense rhythm and melody. Interpersonal intelligence including such skills as responding effectively to other people in some pragmatic way is the ability to understand another person's moods, feelings, and motivations. Intrapersonal intelligence which includes such skills as understanding how you are similar to or different from others, reminding yourself to do something is the ability to understand yourself-your strengths, weaknesses, moods, and desires. Naturalist intelligence is the ability to recognize and classify plants, minerals, and animals. And finally, existential intelligence is the ability to ask and try to answer the big questions which related to existence (Karen, 2002; Shore, 2004; Chen and Gardner, 2005).

Thurstone (1960) and Guilford (1967) argue for the existence of a number of factors of intelligence. According to them, intelligence is multidimensional rather than a single capacity for problem-solving. Although Gardner's theory is believed as a contribution to these, multiple intelligence theory upon neurological, evolutionary, and cross-cultural evidence is based by his attempt. He also emphasizes on the contextual factors (Gardner, 1993).

Sternberg (1985) describes Gardner's theory as a systems approach. But, he considers that Gardner's assessments to be a psychometric nightmare as he believes his approach's instruments demonstrating the psychometric soundness. Then, Sternberg establishes a theory providing process scores for componential processing, coping with novelty, automatization, and practical-contextual intelligence, and content scores for the verbal, quantitative, and figural content (Sternberg, 1991). However Tirri (1997) underlines that Sternberg's theory can be used as a framework in planning a program in the educational setting. Yet, Gardner (1991) stresses that there should be a special interest in how schools encourage the different intelligences in students. Even though Armstrong (1993) indicates Gardner's multiple intelligence theory has been applied in educational settings and in schools, Gardner states educators should not use this theory as the only educational approach (Gardner, 1995). In summary, the views on intelligence have shifted from one-trait-intelligence theories to multiple intelligences theory. Many studies were conducted concerning multiple intelligences theory relationship with many variables, such as gender, academic achievement and other variables. Furnham and Akande (2004); Loori (2005) and Neto *et al.* (2008) studies show there are statistically significant differences between males' and females' preferences of intelligences. Also, Sad and Aribas (2008) find out that the graduated high school effect the students' multiple intelligences.

Inasmuch as the problem solving skills and multiple intelligences are important issues for individual's learning, the present study is to determine the relationship between problem solving skills and multiple intelligences. For this purpose, following research question is the frame for this study:

1. Is there a significant relationship between high school students' problem solving skills and multiple intelligences?

### 3. METHOD

#### 3.1. Participants and Setting

The current study was conducted during 2016-2017 academic year with the participation of 181 male (48.39 %) and 193 female (51.61 %) students who are studying at Zubeyde Hanim Vocational and Technical Anatolian High School and Gazi Industrial Vocational High School. All participants took part in the study voluntarily.

### 3.2. Data Collecting Instrument

This research is based on the relational model. Problem Solving Inventory and the Multiple Intelligences Inventory were used as the data collection tools. Problem Solving Inventory developed by Heppner and Peterson (1982) adapted in Turkish by Sahin *et al.* (1993) was used in order to assess students' problem solving skills. The scale has 35 items. For each item, respondents were asked to rate themselves on a six-point Likert scale (1 = always, 6 = never). The Multiple Intelligences Inventory adapted in Turkish by Ozden (2003) was used in order to assess students' multiple intelligences. The scale has 80 items. And, it consists of ten dimensions. Participants choose the answer they feel most represents to extent to which a statement is true of them (1= Not at all true of me 5= Very true of me to).

### 3.3. Analysis of Data

Data acquired by means of the applications of Problem Solving Inventory and the Multiple Intelligences Inventory was analyzed using the analysis of Pearson correlation via SPSS (Statistical Package for Social Sciences) 21.0 software program. The analysis of Pearson correlation was used to define whether there was a relationship between the problem solving skills and multiple intelligences of high school students.

## 4. FINDINGS

The data was analyzed to explore the relationship between the problem solving skills and multiple intelligences of high school students in this section. And, it was given the results of these analyses.

Table 1. summarizes the following findings which include descriptive statistics on the current research's independent variables.

Table-1. Means, Standard Deviations and Maximum Scores

Scales	Sub-dimensions	N	Mean	Min.	Max.	Std. D.	Std. Er.
PSI	IA	374	28.51	10.00	46.00	7.00	.36
	TA	374	14.38	5.00	26.00	4.80	.24
	AA	374	14.15	4.00	24.00	4.59	.23
	EA	374	8.16	3.00	17.00	3.28	.16
	SA	374	18.29	6.00	32.00	4.90	.25
	PA	374	11.35	4.00	21.00	3.94	.20
MII	NI	374	36.24	12.00	50.00	7.15	.36
	MI	374	35.11	15.00	48.00	6.51	.33
	BI	374	36.88	20.00	50.00	6.31	.32
	Inter-I	374	36.67	18.00	49.00	6.06	.31
	Intra-I	374	36.37	17.00	49.00	6.39	.33
	Log-I	374	34.23	12.00	50.00	6.74	.34
	VI	374	36.90	13.00	50.00	6.28	.32
	LI	374	35.15	12.00	49.00	6.84	.35

PSI (Problem Solving Inventory), MII (Multiple Intelligences Inventory), IA (Impatient Approach), TA (Thinking Approach), AA (Avoiding Approach), EA (Evaluating Approach), SA (Self-trust Approach), PA (Planned Approach), NI (Naturalist Intelligence), MA (Musical Intelligence), BI (Bodily-kinesthetic Intelligence), Inter-I (Interpersonal Intelligence), Intra-I (Intrapersonal Intelligence), Log-I (Logical-mathematical Intelligence), VI (Visual-spatial Intelligence), LI (Linguistic Intelligence).

According to the findings in Table 1, the mean of impatient approach scores of high school students is 28.51. The other sub-dimensions, self-trust approach (18.29), thinking approach (14.38), avoiding approach (14.15), planned approach (11.35), and evaluating approach (8.16) respectively followed each other. And, the mean of visual-spatial intelligence scores of high school students is 36.90. The other sub-dimensions, bodily-kinesthetic intelligence (36.88), interpersonal intelligence (36.67), intrapersonal intelligence (36.37), naturalist intelligence

(36.24), linguistic intelligence (35.15), musical intelligence (35.11), and logical-mathematical intelligence (34.23) respectively followed each other.

In Table 2, the findings regarding the correlation analysis on the relationship between high school students' problem solving skills and multiple intelligences are shown.

Table-2. Correlation Analysis between High School Students' Problem Solving Skills and Multiple Intelligences

		IA	TA	AA	EA	SA	PA	NI	MI	BI	Inter -I	Intra -I	VI	Log- I	LI
IA	R	1	.31**	.31**	.21**	.36**	.29**	-.04	-.15**	-.18**	-.16**	-.09	-.08	-.08	-.18**
	Sig. (2-tailed)		.00	.00	.00	.00	.00	.42	.00	.00	.00	.09	.11	.11	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
TA	R	.31**	1	-.08	.42**	.54**	.59**	-.13*	-.24**	-.31**	-.23**	-.28**	-.29**	-.26**	-.34**
	Sig. (2-tailed)	.00		.11	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
AA	R	.31**	-.08	1	.02	.09	-.10*	.04	.13*	.06	.05	.14**	.09	.05	.09
	Sig. (2-tailed)	.00	.11		.68	.09	.05	.40	.01	.28	.32	.00	.08	.29	.07
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
EA	R	.22**	.42**	.02	1	.37**	.42**	-.16**	-.17**	-.24**	-.23**	-.25**	-.21**	-.24**	-.30**
	Sig. (2-tailed)	.00	.00	.68		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
SA	R	.36**	.54**	.09	.37**	1	.49**	-.11*	-.14**	-.31**	-.25**	-.26**	-.29**	-.26**	-.33**
	Sig. (2-tailed)	.00	.00	.09	.00		.00	.03	.00	.00	.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
PA	R	.30**	.59**	-.10*	.42**	.49**	1	.20**	-.17**	-.31**	-.32**	-.33**	-.25**	-.22**	-.24**
	Sig. (2-tailed)	.00	.00	.05	.00	.00		.00	.00	.00	.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
NI	R	-.04	-.13	.04	-.16**	-.11*	-.20**	1	.31**	.44**	.44**	.57**	.40**	.41**	.30**
	Sig. (2-tailed)	.42	.01	.40	.00	.03	.00		.00	.00	.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
MI	R	-.15**	-.23**	.13*	.17**	-.14**	.18**	.31**	1	.49**	.37**	.34**	.46**	.34**	.36**
	Sig. (2-tailed)	.00	.00	.01	.00	.00	.00	.00		.00	.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
BI	R	-.18**	-.31**	.06	-.24**	-.31**	-.31**	.44**	.49**	1	.64**	.54**	.61**	.39**	.37**
	Sig. (2-tailed)	.00	.00	.28	.00	.00	.00	.00	.00		.00	.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
Inter -I	R	-.17**	-.23**	.05	-.23**	-.25**	-.32**	.44**	.37**	.64**	1	.59**	.47**	.33**	.39**
	Sig. (2-tailed)	.00	.00	.32	.00	.00	.00	.00	.00	.00		.00	.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
Intra -I	R	-.09	-.28**	.15**	-.25**	-.27**	-.33**	.57**	.34**	.54**	.59**	1	.47**	.47**	.48**
	Sig. (2-tailed)	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00	.00
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
VI	R	-.08	-.29**	.09	-.21*	-.29**	-.25**	.40**	.46**	.61**	.47**	.47**	1	.57**	.47**
	Sig. (2-tailed)	.11	.00	.08	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00

Log-I	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
	R	-.08	-.26**	.05	-.24**	-.26**	-.22**	.41**	.34**	.39**	.33**	.47**	.57**	1	.61**
	Sig. (2-tailed)	.11	.00	.29	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
LI	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374
	R	-.18**	-.34**	.09	-.30**	-.33**	-.23**	.30**	.36**	.37**	.39**	.48**	.48**	.61**	1
	Sig. (2-tailed)	.00	.00	.07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
	N	374	374	374	374	374	374	374	374	374	374	374	374	374	374

\* Correlation is significant at the .05 level (2-tailed).

\*\* Correlation is significant at the .01 level (2-tailed).

IA (Impatient Approach), TA (Thinking Approach), AA (Avoiding Approach), EA (Evaluating Approach), SA (Self-trust Approach), PA (Planned Approach), NI (Naturalist Intelligence), MA (Musical Intelligence), BA (Bodily-kinesthetic Intelligence), Inter-I (Interpersonal Intelligence), Intra-I (Intrapersonal Intelligence), Log-I (Logical-mathematical Intelligence), VI (Visual-spatial Intelligence), LI (Linguistic Intelligence).

As can be seen in Table 2, as a result of correlation analysis, there have been found some significant positive and negative correlations between variables. It was found that there is a significant positive correlation between avoiding approach and musical intelligence ( $r=.13$ ,  $p<.05$ ) and intrapersonal intelligence ( $r=.14$ ,  $p<.01$ ). And, there is a significant positive correlation between planned approach and naturalist intelligence ( $r=.20$ ,  $p<.01$ ). Yet, it could be reported that there is a significant negative correlation between impatient approach and musical intelligence ( $r=-.15$ ,  $p<.01$ ), between impatient approach and bodily-kinesthetic intelligence ( $r=-.18$ ,  $p<.01$ ), between impatient approach and interpersonal intelligence ( $r=-.16$ ,  $p<.01$ ), and between impatient approach and linguistic intelligence ( $r=-.18$ ,  $p<.01$ ). Also, a significant negative correlation was seen between thinking approach and naturalist intelligence ( $r=-.13$ ,  $p<.05$ ), between thinking approach and musical intelligence ( $r=-.24$ ,  $p<.01$ ), between thinking approach and bodily-kinesthetic intelligence ( $r=-.31$ ,  $p<.01$ ), between thinking approach and interpersonal intelligence ( $r=-.23$ ,  $p<.01$ ), between thinking approach and intrapersonal intelligence ( $r=-.28$ ,  $p<.01$ ), between thinking approach and logical-mathematical intelligence ( $r=-.29$ ,  $p<.01$ ), between thinking approach and visual-spatial intelligence ( $r=-.26$ ,  $p<.01$ ), and between thinking approach and linguistic intelligence ( $r=-.34$ ,  $p<.01$ ). Evaluating approach is negatively correlated with naturalist intelligence ( $r=-.16$ ,  $p<.01$ ), musical intelligence ( $r=-.17$ ,  $p<.01$ ), bodily-kinesthetic intelligence ( $r=-.24$ ,  $p<.01$ ), interpersonal intelligence ( $r=-.23$ ,  $p<.01$ ), intrapersonal intelligence ( $r=-.25$ ,  $p<.01$ ), logical-mathematical intelligence ( $r=-.21$ ,  $p<.01$ ), visual-spatial intelligence ( $r=-.24$ ,  $p<.01$ ), and linguistic intelligence ( $r=-.30$ ,  $p<.01$ ). It could also be reported that there is a significant negative correlation between self-trust approach and naturalist intelligence ( $r=-.11$ ,  $p<.05$ ), between self-trust approach and musical intelligence ( $r=-.14$ ,  $p<.01$ ), between self-trust approach and bodily-kinesthetic intelligence ( $r=-.31$ ,  $p<.01$ ), between self-trust approach and interpersonal intelligence ( $r=-.25$ ,  $p<.01$ ), between self-trust approach and intrapersonal intelligence ( $r=-.26$ ,  $p<.01$ ), between self-trust approach and logical-mathematical intelligence ( $r=-.29$ ,  $p<.01$ ), between self-trust approach and visual-spatial intelligence ( $r=-.26$ ,  $p<.01$ ), and between self-trust approach and linguistic intelligence ( $r=-.33$ ,  $p<.01$ ). Lastly, it is also viewed that planned approach is negatively correlated with musical intelligence ( $r=-.17$ ,  $p<.01$ ), bodily-kinesthetic intelligence ( $r=-.31$ ,  $p<.01$ ), interpersonal intelligence ( $r=-.32$ ,  $p<.01$ ), intrapersonal intelligence ( $r=-.33$ ,  $p<.01$ ), logical-mathematical intelligence ( $r=-.25$ ,  $p<.01$ ), visual-spatial intelligence ( $r=-.22$ ,  $p<.01$ ), and linguistic intelligence ( $r=-.24$ ,  $p<.01$ ).

## 5. CONCLUSION AND RECOMMENDATIONS

The aim of the present study was to examine the relationship between problem solving skills and multiple intelligences. The findings revealed that there have been found some significant positive and negative correlations between them. While there is a significant positive correlation between avoiding approach and musical and intrapersonal intelligence; between planned approach and naturalist intelligence, there is a significant negative correlation between impatient approach and musical, bodily-kinesthetic, interpersonal, and linguistic intelligence; between thinking approach and naturalist, musical, bodily-kinesthetic, interpersonal, intrapersonal, logical-mathematical, visual-spatial, and linguistic intelligence; between evaluating approach and naturalist, musical, bodily-kinesthetic, interpersonal, intrapersonal, logical-mathematical, visual-spatial, and linguistic intelligence; between self-trust approach and naturalist, musical, bodily-kinesthetic, interpersonal, intrapersonal, logical-mathematical, visual-spatial, and linguistic intelligence; between planned approach and musical, bodily-kinesthetic, interpersonal, intrapersonal, logical-mathematical, visual-spatial, and linguistic intelligence.

Problem solving skills are important in order to achieve the success in school. They also provide the basis for all learning. And, they help for promoting student self-determination. On the other hand, multiple intelligences



allow students to demonstrate what they have learned in different ways. Also, it is believed they could be taught and individual at any age or skill level can become more intelligent by learning. In the light of these, it can be said that problem solving skills and multiple intelligences which are interrelated should be put in the center of school curriculum to provide effective and life-long learning.

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