The Study of Effect of the Main Factors on Problem Solving Self-Confidence Using Cooperative Learning

Shiva Mafakheri1*, Mohsen Rostamy-Malkhalifeh1, Ahmad Shahvarani1, Mohammad-Hassan Behzadi1

(1) Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract

Low self-confidence in problem solving is one of the main issues in terms of mathematics education among high school students and this issue led to decreasing learning mathematics. Mathematics educators always faced to learners that not being proactive for solving the problems and avoid it hence the main aim of this paper is exploring the main influence factors on self-confidence problem solving. Twenty questions of questionnaire were designed based on different literature and principle component and confirmatory factor analysis were used for analysis data. The results of the study indicated the main influenced factors are; ability, motivation, perseverance, sense of helplessness and inhibitor. Finally recommendations and some policies presented to increasing the self-confidence in educational system.

Keywords: Mathematics education, problem solving, self-confidence, cooperative learning, factors.

1 Introduction

Based on Falkenberg’s definition (2006), education is any preplanned activity that aimed to facilitate learning. Mathematics educators always faced to learners that not being proactive for solving the problems and avoid it. Sometimes students do not act to present their solution which represents the low level of their self-confidence on solving the problems [4]. Problem solving as a moral activity is known as a kind of learning. Changing on learner's behavior that shaped based on problem solving is more sustainable than changes that appear via simple learning [5]. The issues that arise of method swiped other criteria of science. Students completely learned the mathematical concepts but they avoid to solving the issues or at least willingness to enter into it. This problem in mathematics education criteria lead to explore and extract the main factors that impacted the self-confidence to solving the problems among students. By this technique, better solution could be found to solve this issue. There are some studies that are conducted through different researchers in this criterion that summarized below; Gok (2012) developed and validated a problem solving confidence questionnaire which would help teachers and researchers to have better
understanding of problem solving confidence of students. According to results of this study, the problem solving confidence questionnaire is a valid and reliable instrument that can be used in the field of science education. He also pointed out that the high level of self-confidence exists among students which challenging their understanding during solving the problem [6]. Self-confidence is the attitude that led to feeling of controlling on life and positive perspective regard to him/herself [1,2]. Characteristics of successful students in mathematics is be described by Serkoak (2000). Based on his definition, students who are successful in mathematics, are not only competent in arithmetic but also in a wide variety of mathematical skills, have more self confidence in problem solving situation, are better prepared to make informed decisions, are more capable of processing information, are more competent at understanding the world around them, have many more career opportunities open to them, can apply mathematical process to many areas of their life and work, appreciate the value of mathematics as a useful tool in everyday living and are better prepared to live in a world of changing technology [9]. Falkenberg and Noyes (2010) presented a conceptual framework that links the teaching school mathematics with moral education. This framework is used to explore the affordances and constraints faced via mathematics teachers in those countries if they want to intentionally practice moral education in the classroom [5]. On other hand, cooperative learning refers to the use of small groups in which students are training to enhance their knowledge with each other and their peers to engage in activities (Johnson & Johnson, 1996) [8]. The results of a study is conducted by Good et al. (1992) that showed when students solving the problems in small groups their attitude toward problem solving developed and become applicable learners [7]. In the same way, the research of Zachariah & Zanatolksan (2007) in Malaysia, indicated a series of studies involved cooperative learning and after the success of this method, the mathematics education system is be amended by cooperative learning [10]. Bishop (2008)’s contributions can be conveniently outlined through a consideration of the following six issues as they relate to mathematics education research [1,2]:

Teacher decision-making,
Spatial abilities, visualization and geometry,
Cultural and social aspects of mathematics education,
Socio-political issues for mathematics education,
Teachers and research, and
Values and teaching mathematics.

The aim of this research is exploring and finding the influenced factors on self-confidence problem solving by using cooperative learning. The main research question is "what are the factors influenced on self-confidence problem solving among students?".

![Figure 1: Modeling of problem solving self-confidence](image)
2 Methodology

2.1. Method, Samples and Tool
Survey method is used in this study. All data information is collected. For this reason, questionnaire is designed for Iranian students that were adopted of Gok's questionnaire (2012). In this questionnaire, 20 questions for evaluating the self-confidence among first grade students of high school in Sanandaj city were designed. The participants selected in this study were 120 students. The participants took about 10 min to complete the entire set of scale. Samples' participation was voluntary and their confidentiality as well as anonymity was ensured as the participants were assigned and identified by a unique code known only to the investigator. The open literature was reviewed to develop the basis for problem solving confidence questionnaire. Responds rated each item on a 5 point Likert scales; "1=strongly disagree", "2=disagree", "3=natural", "4=agree","5=strongly agree". The validation and verification analyses were performed by giving the scale to students. Some of the statistical analyses (Explanatory Factor Analysis, Cronbach's Alpha, etc.) were performed with SPSS and the rest of them (Confirmatory Factor Analysis) were performed with LISREL. Factor analysis is a statistical method used to describe variability among observed and correlated variables in terms of a potentially lower number of unobserved variables that called factors. This method aims to exploring the inner relations among variables and finally grouped them into some specific factors. Validity of the scale was tested with the varimax rotation and principal component analysis. The items were selected, considering the anticipation rule that the item factor load should be over 0.4 as a result of the varimax rotation. The construct validity of the scale was obtained by Bartlett's test of sphericity. For reliability analysis of the scale, Cronbach's alpha was used to examine the reliability of the proposed items within each subscale of the scale. The Eigen values for the factors, variance percentages and total variance percentages for the scale were obtained. Also within the context of reliability analysis of the scale, Kolmogorov-Smirnov test was applied to test that the scale shown a normal distribution.

3 Results

The statistical analysis indicated that the result of Bartlett's test of sphericity was 0.81. Thus multivariate normal distribution was accepted for factor analysis. The value of 0.81 was obtained from KMO from the principal component analysis. KMO test was confirmed with the small partial correlations and sufficient distribution for the factor analysis. With respect percentage of total obtained variance is 65.97 and calculated variance for each factor is more than 1 so it could be concluded that the validity of this variables is suitable.
Table 1: Rotated Component Matrix

<table>
<thead>
<tr>
<th>Questions</th>
<th>Ability</th>
<th>Motivations</th>
<th>Perseverance</th>
<th>Inability</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>0.44</td>
<td>0.53</td>
<td>0.44</td>
<td>-0.13</td>
<td>0.16</td>
</tr>
<tr>
<td>Q2</td>
<td>0.28</td>
<td>0.68</td>
<td>0.4</td>
<td>-0.14</td>
<td>0.16</td>
</tr>
<tr>
<td>Q3</td>
<td>0.06</td>
<td>0.12</td>
<td>0.77</td>
<td>0.02</td>
<td>0.07</td>
</tr>
<tr>
<td>Q4</td>
<td>0.49</td>
<td>0.65</td>
<td>0.26</td>
<td>-0.13</td>
<td>0.08</td>
</tr>
<tr>
<td>Q5</td>
<td>0.61</td>
<td>0.22</td>
<td>0.17</td>
<td>-0.00</td>
<td>0.23</td>
</tr>
<tr>
<td>Q6</td>
<td>0.29</td>
<td>0.59</td>
<td>0.27</td>
<td>0.23</td>
<td>-0.13</td>
</tr>
<tr>
<td>Q7</td>
<td>0.18</td>
<td>0.65</td>
<td>0.04</td>
<td>0.17</td>
<td>-0.1</td>
</tr>
<tr>
<td>Q8</td>
<td>0.23</td>
<td>0.24</td>
<td>0.81</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Q9</td>
<td>0.46</td>
<td>0.1</td>
<td>0.51</td>
<td>-0.13</td>
<td>-0.1</td>
</tr>
<tr>
<td>Q10</td>
<td>0.83</td>
<td>0.11</td>
<td>0.17</td>
<td>0.11</td>
<td>-0.00</td>
</tr>
<tr>
<td>Q11</td>
<td>0.79</td>
<td>0.14</td>
<td>0.12</td>
<td>0.2</td>
<td>-0.06</td>
</tr>
<tr>
<td>Q12</td>
<td>0.73</td>
<td>0.22</td>
<td>0.18</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>Q13</td>
<td>0.27</td>
<td>0.03</td>
<td>0.75</td>
<td>0.07</td>
<td>-0.00</td>
</tr>
<tr>
<td>Q14</td>
<td>-0.06</td>
<td>0.13</td>
<td>0.14</td>
<td>-0.77</td>
<td>0.04</td>
</tr>
<tr>
<td>Q15</td>
<td>0.16</td>
<td>0.38</td>
<td>0.1</td>
<td>0.73</td>
<td>0.12</td>
</tr>
<tr>
<td>Q16</td>
<td>0.11</td>
<td>0.63</td>
<td>-0.11</td>
<td>0.23</td>
<td>0.26</td>
</tr>
<tr>
<td>Q17</td>
<td>0.04</td>
<td>0.36</td>
<td>0.18</td>
<td>0.74</td>
<td>0.29</td>
</tr>
<tr>
<td>Q18</td>
<td>0.03</td>
<td>0.11</td>
<td>0.09</td>
<td>0.48</td>
<td>0.58</td>
</tr>
<tr>
<td>Q19</td>
<td>0.02</td>
<td>-0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.85</td>
</tr>
<tr>
<td>Q20</td>
<td>-0.06</td>
<td>0.49</td>
<td>0.31</td>
<td>0.35</td>
<td>-0.25</td>
</tr>
</tbody>
</table>

Based on Table 1, self-confidence was grouped into five major categories and as could be seen the reliability of questions was confirmed. Group 1 of questions (5, 9, 10, 11, 12) indicate the "ability" of solving problem. Group 2 of questions (1, 2, 4, 6, 20, 16, 7) related to "motivation" in solving problem. Group 3 of questions (3, 8, 13) indicated to "perseverance". Group 4 of questions (17, 14, 15) refer to "inability" in solving the problem. Group 5 of questions (18, 19) indicates to "barriers" factor to solving the problems.

3.1. First Level of Confirmatory Factor Analysis

In this section, results of confirmatory factor analysis of each variable computed based on LISREL separately. It should be noted that reduction of variable and considering them as one factor of loading factor should be more than 0.3. For evaluating the affecting factors structure modeling equation, it is used of LISREL.
3.1. First Level of Confirmatory Factor Analysis

Fig 1 shows measuring the model of self-confidence variable in standard estimation. The results of estimation (below of Fig 2) indicated that this model is suitable. With respect to output of LISREL, total sum equals to 272.82. The chi-square test and the other indices selected for this study are the goodness of index.

3.2. Second Level of Confirmatory Factor Analysis

In first level of confirmatory factor analysis of the questionnaire, we received the dimensions of self-confidence. Continuously second confirmatory factor analysis, we reached to self-confidence in solving problem. The indices of this model illustrated that the data are suitable and how well the data fit the
apriori hypothesized model. The chi-square value obtained is less than 3 and also ARMSE is less than 0.08. Also measuring models in standard estimating situation shows the effect of each variables or factors in distribution of variance of variable marks or main factor. Fig 3 shows the ratio of main factors that have effect on self-confidence problem solving. Ability factor (ratio of 0.86 and a significant number, 8.83) has had the greatest effect on self-confidence, problem solving with an interesting factor called as motivation factor (a factor of 0.76 between 0 and 5.54) has the second largest effect on self-confidence, perseverance in problem solving (a factor of 0.75 or numbers between 5.80) as third factor, barriers for problem solving (factor of 0.33, and a significant number -3.44) effect on self-confidence, inability for problem solving and ultimately fourth factor; esteem problem in problem solving (coefficient significant number of -0.48 and 2.80) has negative effects.

Figure 3: Second Level of Confirmatory Factor Analysis

4 Conclusion

Problem solving is viewed as a fundamental part of learning mathematics. Most researchers working on problem solving agree that a problem occurs only when someone is confronted to a difficulty for which an immediate answer is not available. The first substantive point of this research wants to make, is that improving self-confidence is educational method especially for high school students that is not designed in the mathematics curriculum especially in study area. The second issue of this illustrated paper is the increased the effects of assessment on learning mathematics and the potential for self-confidence solving problems. Subjects who underwent the procedure designed to reduce problem-solving confidence showed significantly lower self-ratings of problem-solving confidence than subjects who underwent the procedure designed to increase confidence. However the mood manipulation did not appear to be successful in changing mood in the expected directions. The main finding of the study was that the problem-solving confidence manipulation (practice) has a significant effect on challenge: subjects who experienced the confidence-reducing procedure emitted significantly more catastrophic steps than subjects who experienced the confidence-enhancing manipulation (practices). It suggests that changes in problem-solving confidence can have a causal effect on catastrophic worry; this reflects an increasing in how
unsuitable potential outcomes of this worry that is conceived and the amount of time that subject is willing to spend ruminating on a particular worry. This is consistent with Davey et al (1996)'s argument that low levels of problem-solving confidence may thwart effective problem solving and exacerbate this worry. Proper instruction as below could be suitable for increasing self-confidence especially in mathematics education:

- Using the standard practices for problems solving that led to decreasing the level of inability,
- Developing and constructing attractive and incentive plans for student that can affect on the level of self-confidence to problems solving,
- Using qualitative evaluation in classroom such as Math Cad led to decrease the failure, and
- Teacher patience of problems solving and presented solution for each problem and listening to other solutions that are proposed via others and encouraging the students to continue on their work that led to attractive classroom's environment for better problems solving.

References

http://dx.doi.org/10.1007/978-0-387-09673-5_5


http://dx.doi.org/10.1007/BF02228037


