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Priority-Setting of Effective Components on the Teaching-Learning Model with an Approach to Improving Problem-Solving Ability

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Abstract

Problem-solving is an ability human beings need to live better lives, however, some do not possess enough of this acquirable skill. Although many studies have concerned themselves with problem solving, this study investigated it from a different angle. The present study aimed at the priority-setting of components effective on the teaching-learning model, with a focus on improving problem solving ability in upper secondary school students. This study used a descriptive-correlational design. The population consisted of professors of the Education Department of Islamic Azad University, Kerman Branch, who were actively working in 2019-2020 academic year, a total of 12 professors. Out of them, 10 individuals were selected as the sample through non-random availability sampling, based on Morgan's table. The questionnaire entailed 12 components and 38 items. Network analysis was adopted for priority-setting of effective components. Furthermore, statistical analyses were conducted using Super Decisions, SPSS, and Excel. The results showed that 'creativeness and creativity' was the most important component, and 'intelligence' the least important component in the teaching-learning model.

***Keywords*:** Creativeness and creativity, intelligence, problem solving ability, teaching-learning model

Introduction[#]

Studies on teaching-learning approaches have, to this date, pursued two fundamental trends: I. A theoretical approach to the teaching-learning process; II. Studying the process of teaching-learning in the classroom. In the meantime, today's complex and ever-changing world mandates a fully-developed, dynamic, and evolved education system (Azwar Surya & Saragih, 2017). The nature of the existing education system and the discipline- and subject-oriented content and presentation, have always been criticized by the scholars of educational sciences, who have pointed out numerous weak points associated with it, including turning knowledge into the goal instead of a means for learning, lack of connection with the student's needs and interests, presentation of incoherent and separate subjects, lack of meaningful comprehension of the materials, and creating a superficial learning among students, among many others. (Hackenberg, 2010; Hackenberg & Lee, 2015, Hackenberg & Lee, 2016; Norton et al., 2015; Ulrich, 2016).

The education provided by schools can possess such comprehensiveness and quality to not only meet the needs of the students in the society, but also prepare them for living in the real world. Therefore, the contents of the existing curriculum in primary schools are required to be changed after the latest studies and research, to motivate students and make them more interested in learning and the school, and furthermore, by activating both hemispheres of the brain, forge deep bonds with the student's needs, issues, and life, to attain the most premium learning there is, ensuring whole-brain functioning (Boyce &

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Norton 2016; Hackenberg, 2013; Hackenberg et al., 2017; Norton & Boyce, 2015; Ulrich, 2016).

The subject-oriented or discipline-oriented curriculum offered in Iranian schools, which transfers materials to the students in chunks, pieces, and shreds, contradicts with the brain's function. In his brain-based curriculum, Talkhabi maintained that the biggest problem school graduates are dealing with is that they are incapable of perceiving the whole picture and identifying the patterns in the newly-offered information; a problem rooted in the teaching methods which adopt a piece-by-piece approach and successive presentation method. He goes on to state that the brain is holistic and cutting it into pieces reduces its functioning and thus limits the ability to perceive the whole (Talkhabi, 2008).

Bahar and Maker (2015) stated that the concept of problem solving is referred to by scientists as a highlevel thinking process consisting of intellectual ability and major cognitive processes (Bahar & Maker, 2015).

The aim and mission of education is to create decent human beings, with the school shouldering the fundamental role; out of all the activities aimed at education and training of students, the largest share goes to the teaching of a teacher in the classroom. Teaching can be defined as mutual activities that flow between teacher and student and target learning; Otherwise put, the process of teaching must provide the students with an opportunity to practice how learning works and to learn learning methods (Nobahar, 2011).

The teaching-learning process is one of the core elements of the curriculum, and through a systematic approach to education, it becomes evident that teaching-learning strategies, as a constituent of the education system, are associated with any changes made to the education system, as viewed by the experts of educational sciences (Zeinaldini Meymand, 2011).

Over time and with the economic, political, and social transformations in societies, education was viewed differently as well. The traditional education's main function was teaching the students how to read, to write in some measure, and to count. The method of education mainly relied on memorization, however, social change turned the attentions towards the determining role and position of education in shaping the socioeconomic capital and how education is expected to prepare today's generation to live in the tomorrow's society, and due to the inadequacies of the existing mechanisms in attaining this goal, a change in the learning system and its various aspects deemed simply vital (Saylor, 2012).

Scientific findings certify that mental health is among the most important needs of today's man, and to secure it, individuals are required to know exactly who they are, to be able to understand others, and establish effective relationships with them. Furthermore, individuals need to identify and harness their negative emotions and everyday stresses, effectively solve their problems, and make decisions accordingly, and to, moreover, think out of the box, not to accept information without processing them first. The requirement for meeting, the essential needs stated above, is a command of life skills. Some such skills are self-awareness, decision-making and problem-solving, coping negative emotions, stress coping, creative thinking, critical thinking, decisiveness, and self-confidence (Naseri, 2008). Individuals are referred to as skilled when they are capable of performing a task properly. For a person to have the skill to perform a specific task, the two factors of time and error need to be considered as well. Accordingly, a skilled driver takes the least time to arrive at the destination, while making the least errors when driving. Evidently, to become skilled in a particular subject, one needs to both possess the know-how and be able to manifest that knowledge to behaviors and actions, through constant practice. The knowledge required for a task can be acquired in various ways (Akinsola, 2008).

Numerous facts exist in the lives of human beings which they will eventually face sooner or later. Life is loaded with problems to be solved and decisions to be made, it is thus highly important to be equipped with a methodology when facing situations that require problem-solving or decision-making (Chinaveh, 2010). Issues, problems, and decision-making are among the items associated with the most important part of human mental health triangle (Gasiri, 2009).

As the outcome of the brain's function, thinking helps us solve problems and make decisions (Brinol et al., 2009). However, if the problem-solving method or decision-making strategy were defective, it would only be natural that our other mental components, namely emotions and behavior, would be inefficiently activated (Rastgoo, 2010).

What matters is not avoiding problems, troubles, difficulties, and choices, but to be able to act properly when afflicted with such occasions. Some individuals even fail to solve their everyday problems, such that slightest issue or decision leaves them distressed, panicked, nervous, and disturbed (Bakhtiari, 2010). At the exact opposite, there are individuals who not only remain untroubled by various problems and difficulties or occasions which necessitate decision-making, but also arrive at a level of self-awareness where they can

improve their weaknesses. The major achievement of such individuals is that when encountering with a problem or making a decision, they adopt a systematic and stage-by-stage method, while the former group lacks the said capability (Babapoor et al., 2003).

Successful exposure to problems and being challenged by them is simply a part of everyday life. Life brings everyone face-to-face with problems, yet they are the ones in charge of devising correct and logical solutions for them. Some are capable of choosing proper solutions to their problems. Yet, it must be borne in mind that with a little reflection and thinking, one can select the best possible solution out of a dozen available, so as to sustain the least amount of damage by the posed problem. The majority of the problems are solvable and will not stress us. Most people do not take the time to solve their problem, therefore miss many of the available solutions. Superficial thinking and rash decision-making will not normally result in an efficient solution to the problem, since such a way of thinking overlooks deep and important components (Beyrami, 2012). Skaalvik et al. (2015) stated that student motivation was strongly predicted by self-efficacy. So, the student's self-efficacy should be taken seriously by the teacher. Teachers must find ways to improve students' mathematical learning ability and must emphasize self-efficacy by designing appropriate learning (Skaalvik et al., 2015).

Problem-solving consists of four steps: 1. Identify the problem: the most important measure to be taken prior to solving a problem is identifying it. In the past, teachers presented the students with pre-specified problems with specific and defined solutions; today, however, teachers try to teach their students the ways to identify real life problems and assess the respective various solutions. 2. Select the Proper Approach for Solving the Problem: after identifying the problem, a proper solution must be sought out. 3. Assess the Solutions: after making the assumption that the problem is solved, the correctness of the solution cannot be ensured unless there is an adequate assessment and evaluation of the selected solution. Solution assessment will provide a clear touchstone of its efficiency. 4. Revise and Amend the Solution over Time: a final and important step in problem-solving is to revise, rethink, and amend the solutions. Good problem-solvers are inclined to improve their former methods and employ new ones. A revision of the submitted project by the student and figuring out a better solution, via assessing visitor feedbacks and judgments, is an example of problem solving (Santrak, 2016).

Curriculum is a secondary realm to education. Delineation of educational processes is only possible through a thorough description of the elements to the curriculum. Any concept within the process of education, including passing on the cultural heritage in a certain society or creating and developing personal growth requirements, guiding personal growth towards the desirable outcome, preparing individuals for seeing through their social roles and duties, are all associated with either formal or informal education systems. Said education system entails information, knowledge, emotions, values, skills, and technically speaking, curriculum content. Selection and organization of content will provide us with the learning facilitations in the process of education, in general, and school curriculums, in particular, which is what curriculum studies are concerned with. It can, accordingly, be claimed that curriculum is as old as education itself (Zeinaldini, 2011).

Teachers and curriculum planners hold perspectives rooted in their worldviews. The worldview determines how individuals view objects and, in turn, is a product of their values, attitudes, and perceptions. It can thus be said that the perspective of a curriculum consists of a fundamental standpoint concerning teaching and learning across various theoretical and practical aspects. Some such aspects are educational ideals, teacher's role, learner's role, the learning process, teaching process, evaluation of the learnings, and the learning environment.

Curriculum can be viewed through various perspectives: behavioral, subject-/discipline-oriented, social, growth-oriented, cognitive, humanistic, and superindividual or holistic perspectives, among many others. Different educational perspectives can be regarded as a continuum with external aspects, like student behaviors, at one end, and internal aspects, like thoughts and emotions, at the opposite end. Naturally speaking, at the center of this continuum is where internal and external aspects interact (Miller, 2016).

Study and research on any of these perspectives indicate that none of them is complete and free of errors and defects; each has its own weaknesses and strengths and thus they can complement each other at times. The present study investigated a comprehensive design and model of teaching and learning, across a various range of theoretical and practical aspects, including seven components of educational ideals, teacher's role, learner's role, process of learning, process of teaching, and the learning environment, in line with improving the problem-solving ability.

Numerous studies have concerned themselves with the teaching-learning approach, many of which have attempted to assess and explain it with regard to

different educational frameworks and education systems, the likes of educational schools, psychological theories, sociological phenomena, and modern technology, among others. However, when it comes to the concepts and fundamentals of the teaching-learning approach, a good example would be the doctoral thesis of Shabani Varaki (2000), as the most important study in this regard. In his thesis, Shabani Varaki, has delineated the positions of teaching-learning approaches adopted by behavioral, cognitive, and humanistic schools, through which he has also investigated and defined the fundamentals and basics of the teaching-learning approach.

The doctoral thesis of Mohammadi Chaboki (2013) investigated the entailments for developing an educational theory following the paradigm of complexity, and based on its components, have pointed out some requirements for developing an educational theory with regard to ontological, epistemological, and axiological principles.

In a study titled 'role of problem-solving skills in eliciting healthy and positive behaviors: presentation and evaluation of a desirable curriculum for elementary school social studies subject', Poorkomoleh et al. (2016), initially proposed a curriculum for elementary school social studies subject with a focus on developing problem-solving skills through curricular elements (objective, content, teaching-learning strategies, and evaluation). Then, views from curriculum experts and elementary school teachers were employed to evaluate the proposed model. To this end, a researcher-made questionnaire was filled by the sample, consisting of 45 curriculum experts, selected through complete enumeration, and 360 elementary school teachers in Gilan province, selected through cluster sampling. Data analysis was conducted using descriptive statistics (frequency and percentage table) and inferential statistics (chi-square test). The findings showed that more than 85 percent of the curriculum experts and elementary school teachers found as desirable the objectives, content, teaching-learning strategies, and evaluation methods of the proposed model. Furthermore, the difference between the views of curriculum experts and elementary school teachers on the desirability of the proposed elements of said model was not statistically significant (Poorkomoleh et al., 2016).

In her study of 2012 entitled 'efficacy of cooperative teaching method on problem-solving skills and attitudes towards mathematics among in-service student-teachers and students of Shahid Chamran University', Yaghootian investigated the efficacy of cooperative teaching method on problem-solving skills and attitudes towards mathematics among in-service student-teachers and students of Shahid Chamran University. Results from MANOVA and one-way ANOVA showed that the problem-solving ability in the experimental group, at $\alpha=0.05$, was significantly higher than the control group. Nonetheless, cooperative problem-solving had no significant effect on the attitude of student-teachers regarding mathematics. Part two of the study consisted of all the students attending bachelor of mathematics at Shahid Chamran University, in the academic year 2011-2012, out of whom 44 were selected as sample and divided into two 22-member classes, using group pairing. One of the classes was randomly designated as the experimental group and the other as the control group.

Students in the experimental group solved problems cooperatively, yet the control group students received traditional teaching. Data from the researcher-made problem-solving ability evaluation test (intended for students) and the attitude toward mathematics inventory (ATMI) were indicative of the fact that problem-solving ability and attitude toward mathematics in the experimental group were significantly better than the control group, at a significance level of $P=0.05$ (Yaghootian, 2012).

Theoretical Framework

This study investigated the teaching-learning approach and its components and touched on the issue that the stages and sequences of teacher/student activities include a range of perspectives, from planning accurate and identical consecutive steps (irrespective of disparate conditions) through to flexible, open-ended, and strategic planning. The teacher and student are both the main and key elements in the teaching-learning approach. Some perspectives hold the teacher as central, and student, passive; in others, the student is the center and the teacher is the guide; yet in some other, teacher and student both actively cooperate in the teaching-learning process. Similarly, the teacher-student relationship can be represented by different perspectives: ranging from a one-way relationship from teacher to the student, through to a multi-way relationship relying on joint cooperation and interaction manifested by mutual activity.

It can, therefore, be concluded that the teaching-learning approach and the impacts of its essential components across different perspectives can be disparate and a result of the foundations upon which the education system is constructed; these foundations may be psychological theories, philosophical schools, or scientific paradigms, based on any of which the teaching-learning approach takes up different orientations.

Furthermore, the studies carried out on problem-solving have a longer history, while those on psychological hardiness and need for cognition mostly date back to recent years. Nevertheless, only recently has serious consideration been put into said variables, their predisposing factors, and the impacts they leave on various aspects of human life. With the increasing plethora of concerns, issues, and problems of today's mechanical modern world, the necessity for fundamental measures to prevent and obviate these complications is being felt more than ever. Amid all this, the construct of problem-solving ability has a significant role to play, since controlling the predisposing factors of the problem-solving ability and using them in a positive manner can prevent many behavioral problems, and as a result, the individual's educational and occupational functioning, and their life in general, will be improved.

Method

Participants

The present study is a practical research in terms of purpose and a descriptive correlation in terms of data collection method. The study population consists of education department professors of Islamic Azad University, Kerman Branch, who had classes in the academic year 2019-2020, a total of 12 professors, out of whom 10 were selected as the sample through non-random availability sampling, based on Morgan's table.

Instruments

The research questionnaire identifies the components affecting the teaching-learning pattern. This questionnaire was determined based on the study of theoretical foundations related to teaching and learning models, which includes 12 components and 38 items. Scoring the questions was in a three-choice range (inappropriate, appropriate, and perfectly appropriate), and the experts commented on each of the components in the range. The results of the questionnaire were evaluated for reliability and Cronbach's alpha was equal to 0.805, which indicates the reliability of the research questionnaire.

Procedure

To evaluate and rank the teaching-learning components affecting problem solving ability, the teaching-learning components questionnaire was electronically sent to the professors. The submitted open-reply questionnaire attempted to identify the components effective on the teaching-learning model. The questionnaire was developed based on the study of theoretical fundamentals for teaching-learning models, and included 12 components and 38 items. This study employed Super Decisions to solve the ANP model, and SPSS and Excel were used for statistical analysis.

Findings

First, with using descriptive analysis and SPSS Software, mean and standard deviations of the identified components were, initially, calculated. Table 1 portrays the mean and standard deviation of the variables.

In order to be able to summarize the opinions of the team of educational experts and also to obtain an average of the pairwise comparisons of this team, the geometric mean of the pairwise comparisons of the respondents was calculated.

Then the geometric mean of each of the quadruple pairwise comparison tables was calculated. After these views, the problem-solving perspective was measured and finally, by combining these two criteria, the final weight of each indicator was estimated.

Adopting ANP process, indicator weights were calculated with regard to the interaction of the two aspects of teaching-learning model and problem-solving ability, as well as the reciprocal interactions of the indicators of each aspect. This method also calculates the reciprocal effects of indicators within each aspect as well as the effects exerted by the indicators of each aspect on indicators of other aspects.

Weight Calculation for Each Aspect

This section attempted to calculate the weight of each aspect, with regard to the table below as well as the conducted pair-wise comparisons and the proposed method by Sami et al. (2009) for calculation of indicator weights in ANP.

Table 1.
Comparison of Scores of Variables

Variable	Descriptive	
	Mean	**SD**
Learning Methods	6.44	5.99
Learning Styles	52.50	26.26
Thinking Styles	68.81	9.14
Intelligence	64.69	4.96
Creativeness and Creativity	65.50	3.88
Learning and Study Strategies	17.31	2.87
Evaluation	17.44	1.79
Learning Approaches	18.94	1.77
Learning Elements	4.88	5.41

Variable	Descriptive	
	Mean	**SD**
Learning Domains	43.25	19.98
Teaching Models and Methods	80.25	6.74
Learning Objectives	62.81	5.92

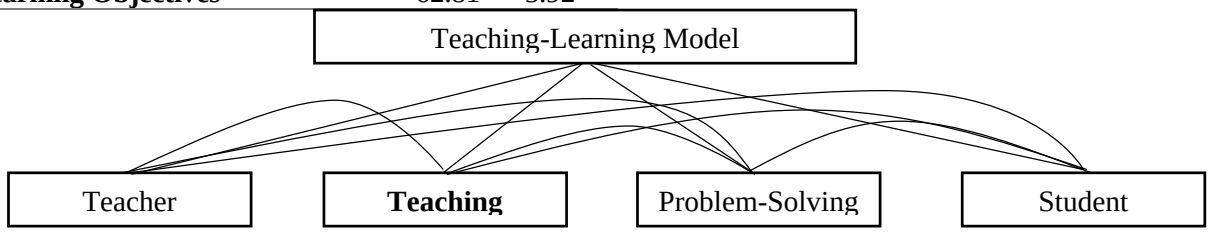

Figure 1.
Interaction of the Fourfold Aspects with the Objective

To obtain the weights of the above four aspects, with regard to the following supermatrix W, the following steps were taken to calculate W_{21}, W_{22}, and weight calculations.

$$W=\begin{bmatrix} 0 & 0 \\ W21 & W22 \end{bmatrix}$$

Considering the estimated weights for each aspect and their indicators via ANP, subsequently, by combining these two criteria, the final weights of the indicators were estimated. The following table shows the final estimated weights for all the indicators.

Table 2.
Weights of the Indicators of the Teaching-Learning Model

Indicator	Weight
Learning Methods	0.068
Learning Styles	0.109
Thinking Styles	0.075
Intelligence	0.056
Creativeness and Creativity	0.153
Learning and Study Strategies	0.086
Evaluation (In Terms of Time and Purpose)	0.07
Learning Approaches	0.07
Learning Elements	0.065
Learning Domains	0.089
Teaching Models and Methods (Depending on How Active the Learner Is)	0.067
Learning Objectives	0.092

Discussion and Conclusion

According to the results, out of the assessed components effective on the teaching-learning model, creativeness and creativity had the highest weight, and intelligence the lowest. Following creativeness and creativity, learning styles, learning objectives, learning domains, learning and study strategies, thinking styles, evaluation (in terms of time and purpose), learning approaches, learning methods, teaching models and methods (depending on how active the learner is), and learning elements, had the highest weight in the teaching-learning model, respectively. Our results showed that the four components of creativeness and creativity, learning styles, learning objectives, and learning domains have a %45 significance, accordingly, they must be taken into account in designing a teaching-learning model aiming at improving the problem-solving ability.

Students enter secondary education with a large number of concepts that represent complex and natural thinking and reasoning ability, reflecting students' daily experiences. In this regard, confirming the relationship between teaching-learning patterns and problem-solving ability is consistent with the results of research by Johoni (2019), Olson (2018). Intelligence priority is also consistent with Graham's 2010 research.

According to the results of research based on prioritizing the components affecting problem solving ability, to use the components of creativity, thinking about issues, how to understand and decide to use the right methods to understand and understand the problems of planning strategy.

Based on prioritized components, to increase students' academic performance in problem solving, identify learners' weaknesses and how to increase the ability to analyze and in-depth review of skills problems or feedback strategy based on the teaching-learning approach can be effective in improving students' problem solving ability. . Accordingly, the need for changes in the educational system in order to emphasize problem-solving skills that can be widely generalized and developed and can be used in various

situations, can be suggested to educational administrators.

As a general conclusion, it can be said that teaching models are directly influenced by approaches and theories of learning and in fact the basis of teaching models are different learning theories, so effective approach and attention to the component of intelligence, creativity and learning styles can improve Students' problem-solving ability is effective.

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