

## The Problem Solving Steps, Related Activities Which Can Be Used in These Steps and Their Evaluation

### Öğretim Yöntemi Olarak Kullanılan Problem Çözme Adımları, İlgili Etkinlikleri ve Değerlendirilmesi

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#### *Abstract*

In this study, based on nine general steps and their related eighty-two activities, which have been developed by the researcher and which can be used in the problem solving process deployed in elementary level social science courses, it is aimed to determine which of the activities stated by the participant teachers to have been performed are actually applied in the class setting, and to find out the reasons for their not applying part of these activities. The original eighty-two activities of problem solving methods are gathered under nine general steps. Based on the observations of classes and interviews with teachers about the eighty-two activities, data is gathered and interpreted. It is found that teachers are not applying the problem solving method and its steps as systematically as they state in the social science courses at the elementary school level. Two of the important results of the research are that teachers are not applying this method because of their lack of adequate knowledge and experience about it and also because of the lack of an easily applicable model for the method. To overcome this problem, in-service training courses should be organized or teacher guides should be published.

*Key Words:* Problem solving steps, Problem solving activities, Social science course instruction

#### *Öz*

Bu çalışmada, ilköğretim düzeyinde sosyal bilgiler dersindeki problem çözme sürecinde kullanılabilecek ve araştırmacı tarafından geliştirilmiş dokuz genel adım ve bu adımlarla ilgili seksen iki etkinlik temel alınarak, öğretmenler tarafından kullanıldığı belirtilen etkinliklerden hangilerinin gerçekten sınıf ortamında kullanılıp kullanılmadığı ve kullanılmayan adım veya etkinliklerin kullanılmama sebeplerinin belirlenmesi amaçlanmıştır.

Seksen iki etkinlikle ilgili olarak, öğretmenlerle yapılan görüşme ve sınıflarda yapılan gözleme dayanarak veriler toplanmış ve yorumlanmıştır. Öğretmenlerin problem çözme yöntemini, sosyal bilgiler dersinde belirttikleri ölçüde ve gerektiği kadar sistematik işlemadıkları belirlenmiştir. Bu yöntemi, yeterli bilgileri ve deneyimleri olmadığı için ve kolaylıkla uygulanabilecek bir problem çözme modelinin yokluğu nedeniyle uygulayamadıklarını açıklamışlardır. Bu zorlukları aşmanın yolu, bu konuda öğretmenlere hizmetiçi eğitim verilmesi ve problem çözme yöntemini kolaylıkla uygulayabilecekleri öğretmen kitapçıklarının hazırlanmasıdır.

*Anahtar Sözcükler:* Problem çözme adımları, problem çözme etkinlikleri, sosyal bilgiler dersi öğretimi.

#### Introduction

Problems generally involve uncertainty and situations that are not known exactly and clearly and involve questions or relations that contain difficulties. In other words, a problem is a state of imbalance, inconsistency and vagueness. Bingham (1958) defines a problem as an

obstacle in the achievement of a target that has been set by the problem solver. He states that all problems have three common points:

- An individual has a self-set aim.
- There is an obstacle before the reaching of this aim.
- The individual is placed under stress as he strives to reach this aim.

Around forty two years after this definition of a problem by Bingham, Adair (1997) offered another

definition: a problem, he said, is a barrier placed in front of you, an obstacle that prevents you from achieving your goal. Stevens (1998) defined a problem as the difficulties present in the transition from a certain setting or state to a more preferred setting or state. For him, problem solving is a process in which some conditions are transformed into other, more preferred conditions. Vangundy (1996) regarded a problem as a gap between the current state and the state that should exist. Kneeland (1999) said that a problem is the difference between the current state of something and its desired state. Definitions of the last two researchers are alike in that they both speak of a difference between two states. Kneeland defined problem solving as an attempt to remove this difference.

The definition of problem solving involves a broad range of activities from the field of mathematics and logic to physical and social sciences. The steps of the solution process vary according to the quality of the problem. Such a variation in the solution process leads to differences in the offered definitions of problem solving. Hence Wilkes (1979) has defined a problem as a thing, event or a person that is difficult to deal with or to solve.

Morgan (1961) defined a problem as a situation of conflict in which a person faces obstacles as he or she is trying to reach an important goal. Problem solving is a thinking process that begins with the recognition of the problem and ends with its solution. In the study of Jonassen (2000) problems are classified under eleven main categories. According to this classification, our study can be regarded as a Design Problem based on his classification criteria.

### The Steps of the Problem Solving Process

Problem solving could be defined as a cognitive-behavioral process in which certain logical steps are followed systematically to solve the problem at hand. Gagne (1970) views problem solving as an intellectual skill and groups the learning outcomes into five categories as follows: intellectual (mental) skills, verbal knowledge, motor or behavioral skills and, cognitive strategies.

Dewey (1910) undertook some research on the problem solving process and developed a problem solving method based on principles related to Reflective Thinking. In the process of scientific problem solving both deduction and induction are used simultaneously. By his study Dewey formed the necessary theoretical basis of the scientific method for educational uses.

Dewey (1910) stated that thinking and problem solving are closely integrated. In this sense, according to Cahan (1992), Dewey assumed that thinking is the same as questioning. At the same time, as stated by Greenberg (1992), Dewey regarded classrooms as scientific laboratories. The "Approach of Learning by Problem Solving" method is as follows:

- Recognition of the problem and its existence
- Gathering of the data related to the problem
- Development of solutions
- Testing the solutions by trial and error
- Gathering of information about the implementation of the solutions
- Summarizing the steps that are used up to this point
- Developing a new application plan based on lessons learned from previous steps.

The steps included in Barth's problem solving model (1996) are as follows:

- Experience
- Variation and uncertainty
- Identification of the problem
- Developing a testing mechanism
- Research and proof
- Generalization

Hicks's (1994) model, which requires an individual to know beforehand a problem-solving model, is made up of six steps. The individual should rearrange it according to his or her own conditions. The steps are as follows:

- Problem (Mess)
- Data collection
- Redefinition
- Development of the proper solutions
- Selection of the best solution
- Approval of the solution and implementation

Bagayoko, Kelley and Saleem (2000) stated that in every kind of problem solving method, the five main steps that constitute the problem solving model have to undergo considerable improvement.

Arenofsky (2001) developed a three step problem solution model:

- Acknowledgement of the existence of a problem; identification of its limits and conditions
- Creation of the proper strategy to solve the problem; data collection; necessary information and source collection necessary for the application of the created strategy.
- Monitoring the problem solving process as a whole and the evaluation of the solution

In Shor's (1980) problem-solving model, in turn, the first step is observation, the second one is investigation, and the third one is solution. The "observation" step is carried out to define the problem. In the second step, "investigation", research is carried out in order to test the hypothesis. In the third step, "solution", the original problem is restructured.

Bingham's (1958) eight-step model is as follows:

- Acknowledgement of the need to solve the problem
- Explanation of the problem, acquiring familiarity with its characteristics and field; attempt to comprehend the other related problems
- Collection of the information
- Selection of the proper data and its arrangement
- Identification of the possible solutions
- Evaluation of the possible types of solution and selection of the best one among the alternatives
- Implementation of the accepted solution
- Evaluation of the method employed

Seefeldt and Barbour (1986) pointed out that a child who attempts to understand how a carpet becomes wet and a scientist who tries to find a cure for cancer use the same steps of the problem solving process. Cahan (1992) emphasized the utility of Dewey's problem solving approach in an elementary school setting.

#### Related Studies

Bock and Laurice (2000) stated that the problem solving method is used with the aid of experts to help the children who have difficulties in academic learning. West and Idol (1990) developed a model that could be used for problem solving in groups.

Bagayoko, Kelley and Saleem (2000) have proposed a new problem solving model. They divided problems

into two groups as ordinary problems and academic problems. The distinction between them is that the academic problems are fully defined, whereas the ordinary problems cannot be defined in full.

Gustafson and Rowel (1998) also proposed several technological problem solving models. In the study children develop a planning strategy to solve problems with experts' help.

Lee-Kam et al. (2000) conducted a study to determine at which level primary school science teachers could teach the problem solving method. The majority (65 %) of them stated that they used the problem solving method in their science courses. It was reported however that the teachers did not know this method very well and they did not employ it effectively. Our research has also produced similar results.

Lawrens (1990) found that, although problem solving is one of the goals of the American Basic Education Curriculum, its practice is significantly different. Problem solving is not adequately applied in schools. This finding is parallel to the situation in Singapore and in Turkey.

Fensel and Motta (1997) argued that the field of application is not so important, as problem solving can be used in all structures, functions and topics. With the use of quality examples, problems can be solved more easily through computers. The reasons for teachers' ignorance of this method are investigated in various studies like Clark and Peterson (1986), Aubusson and Webb (1999), Laat and Watters (1995) and Ramsey and Gassert (1996). In these studies, the factors that have an impact on the teaching methods and strategies of teachers on the topic of problem solving are examined. Such factors are grouped into two classes as external and internal.

Campagne and Klopfer (1997) and Rutherford and Ahigren (1990) argue that whether the topic given to the students is from a social field or a science field is not important. What is really important is giving a topic which students will think about and solve by using the problem solving method.

Newmann (1988) and Newton and Gott (1989) found that although most of the primary and secondary school teachers believed in the importance of the application of the problem solving method, they were not using it at the desired level.

Fidan (1980) pointed out that teachers use the teaching methods that depend on information transmission more frequently than those that foster the skills of problem solving, discussion, inquiry, and collaborative work. This result is similar to that of the study by Lee-Kam et al. (2000). In that study, the reason for teachers' not applying the problem solving method is their lack of sufficient knowledge about the method. Chin et al. (1994) also support this conclusion in their study. Harty, Kloosterman and Martin (1991) found that problem solving and critical thinking skills were indeed included in the curriculum, but teachers' practice was different in reality. This is similar to the situation in our country. Britz (1993) dealt with the skills necessary for teachers to teach the problem solving method to their students. For this aim, the teacher should:

- create a problem solving environment
- make available the time necessary for the learning process
- prepare a setting for it
- use the materials necessary for problem solving
- have the necessary knowledge and experience about the method
- choose the proper problem to be solved

Tegano, Sawyers and Moran (1989) emphasized the importance of the atmosphere in which teachers consider the problems and the solutions proposed by the students. In the ideal atmosphere, none of the solution methods proposed by the students will be handled with contempt or condescension; instead, they will be treated as being as valuable as adults' ideas. Moyles (1989) reported that problem solving requires time and that the student needs sufficient time to think about how to solve the problems and to apply his ideas for its solution. For Moyles testing is a critical factor, and an equally important point is the use of a rich range of materials.

Britz's fifth item is also parallel to Dewey's argument that experience about problem solution and its methodology are very important for teachers and students alike.

The purpose of using the problem solving method in social science courses is to develop the skills of scientific thinking in students. Learning is an accumulative process and the learning that takes place in elementary education is of fundamental importance for learning in the cognitive, affective, and psycho-motor

domains. As a first phase of the study, nine general steps and their related eighty-two activities, which can be used in the problem solving process deployed in elementary level social science courses, have been developed by the researcher.

In the second phase of the study, it is aimed to determine which of the activities stated by the participant teachers to have been performed are actually applied in the class setting, and to find out the reasons for their not applying part of these stated activities.

## Method

### *The Model of the Study*

The present study can be classified as a descriptive research since it aims at determining the usage level of the various steps and their related activities of the problem solving process in social science courses.

### *The Participants*

The research for the present study has been carried out in a number of elementary education schools located in Ankara. These schools have been chosen especially in those areas where the average socio economical status is high, since the chances that the method is being used in these areas are considerably higher. Fifteen teachers who have an experience of more than fifteen years have been selected as the participants of the research.

### *The Data Collection Tools*

Two data collection tools are employed by the researcher in the study: semi-structured interviews and semi-structured observation forms. Both forms used in this study consist of nine different steps, which contain eighty-two activities in all, to be used for the problem solving procedure.

These steps and activities can be found in full in the section entitled "The Findings and Their Interpretations". Below is an outline of the nine steps which include eighty two activities in detail.

- Explanation of the steps of the problem solving method
- Understanding the problem
- Gathering information related to problem solving
- Analysis and interpretation of the information related to problem solving
- Identification of the solution(s)

- Selection of the most effective solution(s)
- Development of a report on problem solving
- Presentation of the problem solving report
- Evaluation of the application of the problem solving method and its correction, if necessary.

#### *Data Collection and Analysis*

The tools (the two semi-structured forms) of the study were organized by interviewing the teachers who were involved in the study. Six education experts reviewed the validity of the tools. The interviews have a three item scale (yes; no; other), as does the observation form (observed; not observed; other).

Five classrooms were observed by three different observers in order to achieve reliability. Spearman's rhos were found to determine the consistency among the observations which ranges from 0.77 to 0.83. Cronbach alpha is identified as 0.88 for achieving reliability of the observation form (tool). The interview form was completed by interviewing fifteen teachers from three schools. Through interviewing, it was determined which of the eighty two activities were realised in a class setting by participating teachers.

Additionally, in the interview form, the data such as opinions, suggestions and reasons put forward for not applying the method were included as data in the research. The data collected in the tables are not given in

Table 1.

*The Results of Interviews and In-Classroom Observations about the Views of Teachers on the Steps of Problem Solving.*

	INTERVIEW		OBSERVATION	
	(N= 15)		(N=15)	
The expected activities in the classroom	Yes	No	Observed	Not
	(%)	(%)	(%)	Observed (%)
1 Understanding the problem	40	60	6,67	93,33
2 Gathering the information related to the problem	33,33	66,67	6,67	93,33
3 Analyzing and interpreting the related information	33,33	66,67	6,67	93,33
4 Identifying the solutions	40	60	6,67	93,33
5 Selecting the most effective solution(s)	40	60	6,67	93,33
6 Developing a report	26,67	73,33	6,67	93,33
7 Presenting the report	26,67	73,33	6,67	93,33
8 Evaluation/correction	33,33	66,67	6,67	93,33

full in the present study, though some are given in the context of the interpretation of the results. The teachers were asked to determine a problem case which was suitable for the social science course content. Later on, they were asked to solve and to help students to solve that predetermined problem case by using the steps and the activities they said they were using in class settings. The applications of these steps and activities were observed.

The observation form was filled in according to the observation of fifteen teachers for 360 minutes in three different schools. In the class, the observation form was used to identify whether there was a disparity between the data gathered in the interviews and the actual practice of the fifteen teachers involved in the research. The reasons put forward for not applying some steps as well as the application of related activities than those originally suggested, if any, were collected.

#### The Findings Of The Research, Their Analysis And Interpretations

In this section the findings related to the application of the steps of the problem-solving procedure are analyzed through the use of proper statistical techniques and interpreted on the basis of this analysis.

See Table I.

*The Steps of Problem Solving*

As shown in Table I, most of the teachers did not explain the first eight activities (here, they are the names of the general problem solving steps) in full to the students. The activities (names of the general steps of the problem solving process) 1, 4 and 5, were carried out by only six of fifteen teachers (40 %). Comparison of the in-classroom observation and interviews shows that these activities were not applied widely (6.6%). In the interviews, the teachers reported that they used the activities extensively (26.6%). But, in class observation, this rate of the usage of activities dropped to 6.7%. Consequently, there was a disparity between what was

said and what was done in the class. In the interviews, five of the teachers (33.3%), in giving the reason for their not using the activities in question, said that it was not necessary to explain these activities at the beginning of the class. Four of the teachers (26.7%), in answering the same question, said that explaining the activities at the beginning of the class might reduce the students' interest in the topic. When these activities are not explained at the beginning however, the way to be followed by the students may remain unclear for them, with the result that they will remain ignorant of the techniques that will lead them to the solution of the problem at hand.

Table 2.  
*Results of Interviews and In-Class Observations Related to the Teachers' Views on the Understanding the Problem*

The expected activities in the classroom	INTERVIEW (N= 15)		OBSERVATION (N=15)	
	Yes (%)	No (%)	Observed (%)	Not Observed (%)
9 Explaining whether the study will be done individually or as a group	26,67	73,33	6,67	93,33
10 Introducing the related problems	100	0	100	0
11 Selecting one or more problem from related problems	66,67	33,33	60	40
12 Asking the known information about the selected problem	93,33	6,67	86,67	13,33
13 Asking the unknown information about the selected problem	53,33	46,67	53,33	46,67
14 Asking whether other related problems are known or not	53,33	46,67	53,33	46,67
15 Asking whether the students dealt with a similar problem before	40	60	13,33	86,67
16 Dividing the problem into smaller parts	86,67	13,33	73,33	26,67
17 Making a table using these parts	40	60	0	100
18 Developing a connection among the parts	40	60	0	100
19 Asking the type of the problem	46,67	53,33	26,67	73,33
20 Asking how much immediate this problem is	86,67	13,33	86,67	13,33
21 Asking how much important this problem is	100	0	100	0
22 Asking the responsible persons for the problem	100	0	100	0
23 Definition of the problem	100	0	80	20
24 Definition of the problem in different ways	73,33	26,67	40	60
25 Identifying the goals	66,67	33,33	6,67	93,33

### Understanding the Problem

As shown in Table II, according to the interviews, eleven teachers (73.3%) were applying activity 9. According to the statements of the teachers, all of them were applying activities 10, 21, 22 and 23, but only ten teachers (66.7%) were applying activity 25, "the definition of the goal". In the class observation, in contrast, it emerged that only one teacher (6.67%) was actually performing activity 25. Since defining the goal is a critical activity, having so low a rate in its application is highly unsatisfactory and hinders the teachers from reaching the instructional goals and from making the students aware of the importance of defining

the problem at hand. Fourteen teachers (93.3%) said that they were applying activity 12. However, eight teachers (53.3%) out of those 14 confessed that they were not performing activity 13, which is however essential for activity 12.

When asked about why they did not use activity 13, fourteen teachers replied that asking this kind of question was not important. The other four teachers said that they had never thought about asking such a question. What makes the situation even more problematic is that although another seven teachers (46.7%) said in the interview that they applied activity 13, this activity was carried out in only three classes (20%) according to the observation results.

Table 3.

*Results of Interviews and observations about the Views of Teachers on the Information Gathering Related to the Problem*

	The expected activities in the classroom	INTERVIEW		OBSERVATION	
		(N= 15)		(N=15)	
		Yes (%)	No (%)	Observed (%)	Not Observed (%)
26	Explaining the importance of the information gathering related to the problem in the problem solving	60	40	6,67	93,33
27	Asking the aims in the information gathering	40	60	6,67	93,33
28	Discussion of the necessity of the information gathered in the problem solving	60	40	6,67	93,33
29	Discussion of the sufficiency of the information gathered in the problem solving	40	60	6,67	93,33
30	Discussion regarding the collection of how much of an information unavailable can be gathered	33,33	66,67	6,67	93,33
31	Discussion of the starting point of the information gathering	60	40	6,67	93,33
32	Discussion of where the necessary information can be found	80	20	100	0
33	Asking the questions of 5W 1H in reaching the information	60	40	0	100
34	Determining the techniques and tools to collect the information	33,33	66,67	0	100
35	Discussion regarding the appropriate activities for the information usage	33,33	66,67	6,67	93,33
36	Discussion of the advantages of the information reached for a specific step	40	60	6,67	93,33
37	Discussion of the classification of the information obtained	40	60	6,67	93,33
38	Using the force field analysis, SWOT analysis	0	100	0	100
39	Reviewing the information related to the problem	26,67	73,33	26,67	73,33

There was also a great disparity between the results of the interviews and observations related to activities 17 and 18, activities that are highly integrated. Dividing the problem into smaller related pieces, making a table of them, and establishing the relations among the pieces should definitely be taught to the students, since this method of teaching prevents memorizing and encourages understanding and comprehension. This is because comprehension of a subject is establishing relations among the pieces of information, and memorizing implies nothing other than the failure to establish those relations. In ten classes, however, (73.3%), activity 19 was not applied, which points to an important problem. During the application of the problem solving method, the failure to ask the questions about the things that are unknown to the solver of the problem can alter the course of application of the "information gathering" step and impact upon the problem solving process in a negative way. Failure to

ask the question in activity 19 then, leads to a highly inadequate application of the problem solving method.

Gathering Information Related to the Problem

As shown in Table III, nine teachers (60%) indicated that they applied activities 26, 28 and 31; six teachers (40%) that they applied activities 27, 29, 36 and 37; and finally five teachers (33.3%) that they applied activities 30 and 35. When we look at the observation results, however, in only one class (6.7%) were all these activities being performed in full. There was hence a great disparity between deeds and words. When the teachers were asked about this matter, their answer was mostly something like "the application of these activities is not as important as you make it".

When we turn to activity 31, "Discussion of the starting point of information gathering" and activity 34 "Determining the techniques and tools to collect the

Table 4. *The Results of Interviews and Observations about the Views of Teachers on the Analysis and Interpretation of the Information*

	The expected activities in the classroom	INTERVIEW		OBSERVATION	
		(N= 15)		(N=15)	
		Yes (%)	No (%)	Observed (%)	Not Observed (%)
40	Finding the real reason of the problem	86,67	13,33	93,33	6,67
41	Estimating what happens if the problem is not solved	93,33	6,67	93,33	6,67
42	Developing concept and mind maps	20	80	6,67	93,33
43	Implementing the SRRC model	0	100	0	100
44	Asking repeatedly the "why" question toward the problem statement	53,33	46,67	40	60
45	Supporting the creative ideas	100	0	80	20
46	Reviewing the activities implemented by the group	60	40	53,33	46,67
47	Discussion of the major goal to be achieved	33,33	66,67	53,33	46,67
48	Identifying the limits on money, space, time equipment, human resource	86,67	13,33	0	100
49	Taking necessary notes on these limits	60	40	60	40



information”, nine teachers (60%) said that they applied the former and five teachers (33.3%) that they applied the latter in the interview. However, in the observation, the reality turned out to be very different than this, since neither of the two activities could be observed in the class. When the reasons for this disparity were asked of the teachers, thirteen out of fifteen said that they did not apply the activities in class because they themselves did not know how to use and apply them. They also gave the same reason for their failure to apply activity 38.

As shown in Table IV, in the case of activity 41, interestingly, both interview and observation yielded the same results. In activity 45, the correlation between the data obtained in the observation and interview were similarly high. This high rate of actual application of these activities is very important as it will no doubt enhance the creative activities in the school setting.

In Table IV it can again be observed that in the case of activity 48, “identifying the limits on money, space, time, equipment and human resource”, thirteen out of fifteen teachers (86.7%) asserted that they performed it during their interviews, whereas it emerged from the observation results that none of them were actually applying it in class. When the teachers were asked the reason of their failure to apply activity 48, their response was: “Because of the heavy work load in the curriculum, we do not have enough time to apply all the activities with due concentration and order.”

As shown in Table V, for the activities from 50 to 53, the results of the interviews and the observations are consistent in that the teachers were actually applying in the class what they said they performed in the interview. The reason for the high rate of application of these activities in the class is the fact that the teachers were

Table 5.

*Result of Interviews and Observations about the Views of the Teachers on the Identification of Solutions*

	INTERVIEW		OBSERVATION	
	(N= 15)		(N=15)	
The expected activities in the classroom	Yes (%)	No (%)	Observed (%)	Not Observed (%)
50 Implementing the brain storming technique	55,33	46,67	40	60
51 Implementing the 6 thinking hats technique	6,67	93,33	0	100
52 Implementing the idea development technique	0	100	13,33	86,67
53 Implementing the advantages/disadvantages technique	80	20	86,67	13,33
54 Negotiation technique	80	20	6,67	93,33
55 Implementing oyster trap technique	6,67	93,33	6,67	93,33
56 Writing down the solutions found	73,33	26,67	26,67	73,33
57 Discussion of the reasons of the selection of the solutions within the group	73,33	26,67	80	20
58 Developing solutions other than developed ones	66,67	33,33	66,67	33,33
59 Noticing the solutions developed to the class by posting them on the wall	40	60	6,67	93,33
60 If common solutions are developed, discussion on solutions with other groups	86,67	13,33	73,33	26,67
61 Emphasizing the importance of decision making	73,33	26,67	26,67	73,33

trained about the activities 50-53 previously in in-service training seminars. We can infer from this fact that if we can adequately train teachers in qualified in-service training seminars on specific topics they can easily apply their new skills in the class. Activity 60 was also applied in most of the classes. About this activity, "If common solutions are developed, they are discussed with other groups" it is stated that provides face-to-face communication and improves the social skills necessary for the future life of students. Because of this benefit of this activity, its application in class yields very positive results.

When we look at the information classified as "others", in turn, we can see teachers complaining that the problem solving method is given to them in a too theoretical manner and because of the lack of practical application, they tend to forget the abstract content easily and completely.

The set of activities classified under the title "views of the teachers about the selection of the most effective solution" is the most important, but also the most difficult group to implement among the others in the problem solving method. This is because the activities numbered 62-66 are the core of both the problem solving method and the effective decision making process. These activities have to be implemented with full explanations and understanding in the class for ensuring on effective decision-making and problem solving process.

When we examine the observation of the activities 62-66, we can see that they were not being emphasized as much as they ought to be. But allowing these crucial activities to be learned only superficially by the students will influence the proper application in a highly negative way. The decision taken in the following activities will probably prove incorrect or insufficient for the problem as a result.

Table 6.

*Results of the Interviews and observations about the Views of the Teachers about the Selection of the Most Effective Solution*

The expected activities in the classroom	INTERVIEW		OBSERVATION	
	(N= 15)		(N=15)	
	Yes (%)	No (%)	Observed (%)	Not Observed (%)
62 Discussion of the risks of the potential decision making	55,33	46,67	0	100
63 Stressing the minimizing the errors in the decision making	20	80	6,67	93,33
64 Pointing out that experience and intuitions may be influential in the decision making	33,33	66,67	6,67	93,33
65 Stressing the possibility of modifications that may be made in the decisions	20	80	6,67	93,33
66 Stressing the need for the testing the decisions before it is used as a final decision	60	20	40	60
67 Stressing the reasons of the selection of the most effective solution(s)	86,67	13,33	93,33	6,67
68 Discussion of the corrections in the wrong implementation of the solutions	73,33	26,67	46,67	53,33
69 An example implementation	20	80	13,33	86,67
70 Explaining and implementing the most appropriate solution(s)	80	20	73,33	26,67

The application ratio of activity 67 is interestingly much higher than the preceding ones. But although the five activities preceding this one are absolutely necessary for the validation of the reasons shown for the choice of a specific solution, fourteen of the fifteen teachers failed to perform them. This implies that they reached a decision (solution for the problem) without duly validated reasons. This failure is bound to place the validity of their solution under doubt and it will be very probable that the solution they have reached is an invalid one based on invalid reasons.

#### *Developing the Report*

As shown in Table VII, two teachers said in the interview that they applied activities 71-74, and another thirteen that they did not apply them. In the observation, however, none of the fifteen teachers were seen to be applying these activities, that is, reporting on the problem solving process. The reason for not applying these activities, according to the teachers who did not apply them, was that reporting the whole problem solving process would take too long.

#### *Presenting the Report*

According to the results of Table VIII, fourteen out of fifteen teachers did not complete the report presentation step. In one class, nevertheless, a student made a presentation about what he had done to solve the problem. However, even this student did not have a written record of the problem solving process.

#### *Evaluation/Correction*

When we examine Table IX, we can see that in the interviews a small number of teachers said that they applied activities 78-82 and the rest said they would not apply them. In the observation, however, it was observed that none of the teachers actually applied these activities in class.

As evident from the last three sections in this study, omitting or not giving enough importance to these activities will be to the detriment of the problem-solving training. Without preparing a report or making a written record of what has been done in the problem solving process, without presenting this written record and

Table 7.

*The Results of the Interviews and Observations about the Views of the Teachers on the Development of the Report Related to Problem Solving.*

	The expected activities in the classroom	INTERVIEW		OBSERVATION	
		(N= 15)		(N=15)	
		Yes (%)	No (%)	Observed (%)	Not Observed (%)
71	Writing down the process that is followed throughout the study	13,33	86,67	0	100
72	Explaining the problems occurred in the process	13,33	86,67	0	100
73	Explaining the achievement of the information, decisions and the most effective solution at each activity of the problem	13,33	86,67	0	100
74	Developing a report on the topic as a whole	13,33	86,67	0	100
75	Developing suggestions for the future study on the topic	0	100	0	100

Table 8.

*The Results of the Interviews and Observations about the Views of Teachers on the Presentation of the Report.*

		INTERVIEW		OBSERVATION	
		(N= 15)		(N=15)	
The expected activities in the classroom		Yes (%)	No (%)	Observed (%)	Not Observed (%)
76	Verbal presentation of the report to the class	20	80	6,67	93,33
77	Using various equipments and techniques in the presentation of the reports	13,33	86,67	0	100

Table 9.

*The Results of the Interviews and Observations about the Views of Teachers on the Evaluation and Correction of the Report*

		INTERVIEW		OBSERVATION	
		(N= 15)		(N=15)	
The expected activities in the classroom		Yes (%)	No (%)	Observed (%)	Not Observed (%)
78	Evaluation of the report in terms of its content	13,33	86,67	0	100
79	Evaluation of the study in terms of process	20	80	0	100
80	Evaluation of the report in terms of its formal features	13,33	86,67	0	100
81	Evaluation of the presentation of the report	13,33	86,67	0	100
82	Identifying the problems accrued in the study process as a whole and reviewing the process to correct the mistakes and turning back to the starting point of the process.	13,33	86,67	0	100

finally without evaluation of the whole problem solving process, the skills report preparation, presentation, listening and evaluation will remain inadequate.

### Results

The results of the present study can be listed as follows:

There are great disparities between the data obtained from interviews with teachers and the data obtained from the observation of their in-class performance. The reasons for this situation can be explained as follows:

- They assume that they actually perform the activities indicated in the interview-observation forms, though in reality they are not doing so.
- They may be hesitating to confess the inadequacy of their skills in performing the activities.
- They point to the fact that in the schools they graduated from, the problem-solving method was taught to them in theory and practice in the science courses, whereas, in the social courses, the problem-solving method was covered only superficially without showing any applications.

- They also indicate that they lack adequate knowledge about sound and modern problem solving methods.
- They also assert that such a rigorous application of the problem solving method in elementary level social science courses is not possible because of the heavy workload in the curriculum.

The research reveals that for such reasons teachers are not able to apply the modern scientific methods of problem solving process and instead, they mainly use traditional methods for solving problems. This situation restricts the application of scientific problem solving methods and their application to problems that occur in cases from real life.

Interestingly, some activities in the list of activities were observed to be applied more widely than the others. The reason stated by teachers for this situation is that they have been taught activities in their in-service training programs, and therefore do not experience so much difficulty in applying them in the class.

Because the activities about adequate, clear and precise preparation, presentation and evaluation of reports about the problem solving process were not applied, however, the students and the teacher were observed as being unable to understand the entire set of activities in the problem-solving process to the expected degree. This is the result of the fact that they are unable to discern the points where more elaboration is needed and those that have been left untouched.

### Suggestions

The teachers involved in the study appear to be knowledgeable as far as the activities about understanding the problem and about information gathering are concerned. They report, however, that their knowledge about how to implement them is inadequate. In order to overcome this problem, in-service training courses should be organized or teacher guides should be published.

Most of the activities related with finding a proper solution for the problem at hand, in contrast, are new. In order to teach the students these problem-solving activities, teachers have to be trained before so that they learn how to solve problems in an applied manner. For this purpose the courses in teacher training institutions should be restructured and the newly developed techniques should be taught to the students of pedagogy.

It has emerged from the study that the problem solving method, in its entirety (together with project-based learning or groupwork), cannot be implemented in schools because of the heaviness of the workload. The curricula should therefore be organized in a way that would allow such active learning-teaching techniques.

Because of the importance of properly reporting on the problem-solving procedure for the students in their future life, activities about the preparation, presentation and evaluation of the problem solving process should be properly taught to the students and their teachers. Before all, of course, students and teachers should be persuaded of the importance of these skills.

The eighty-two activities designed for the problem solving process have been designed as an activities sequence by the researcher and tested in elementary schools in order to provide feedback for further study and for reaching an easily applicable model and improved results.

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