THE PROBLEMS ENCOUNTERED IN DESIGNING CONSTRUCTIVIST LEARNING ENVIRONMENTS IN SCIENCE EDUCATION AND PRACTICAL SUGGESTIONS

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ABSTRACT
The aim of this study is to determine the needs and problems of classroom teachers about designing constructivist learning environments and to lay down the practical suggestions concerning these problems. To this end, a total of 94 classroom teachers from 81 provinces who participated in the workshop aimed at designing constructivist learning environments within the framework of SBEP project were included in the scope of this study. The groups evaluated their own learning environments. Based on these evaluations, they formed documents which included defining their needs, the problems encountered and practical suggestions. It was concluded by means of document analyses that the learning environments were not real-life oriented, that they did not sufficiently relate to students' experiences, that the constructivist approach was not grasped efficiently and that students were not properly granted autonomy in learning process.
Keywords: Learning environment; constructivism; primary education curriculum

INTRODUCTION

Recent changes and developments experienced in the world today openly reveal the truth that the knowledge, skills, attitudes and alike which are meant to be acquired by individuals need revising as well. The fact that individuals in today's world are expected to produce knowledge rather than just absorb it requires active participation in creating meaning by interpreting knowledge instead of taking the knowledge directly as it is given or to be passively and shaped. This therefore, requires academic curricula to be designed that facilitate and raise individuals possessing.

The 1980s are considered to be the early years of world-wide reform movements in education, especially in science and mathematics education. A report issued in the USA in 1983, *A Nation at a Risk: The Imperative for Educational Reform,* argued that academic standards had fallen in the U.S. as evidenced by the embarrassingly low test scores of American youth, especially in math and science. The suggested solution was to create more rigorous academic curricula. Similarly, many countries like Australia, England, France, Russia and China started reform movements in education in the following years. The rationale provided by these countries for reform movements was for new curricula to ensure transition from teacher-centred approach to student-centred approach (Smerdon, Burkam & Lee, 1999; Gough, 1999; Boyd, 2000; Sani, 2000). These countries also negotiated on new assessement techniques and started to apply TIMSS.

Turkey participated in TIMSS (Third International Mathematics and Science Study) assessment in 1999 for the first time and Turkish students ranked as 33rd out of 38 countries. TIMSS is an international educational assessment study. 38 countries jointed in this study which were mostly from Europe but also from Asia, Australia and United States of America. The PISA (Programme for International Student Assessment) which is another international assessment study results in 2003 and 2006 showed similar results. 41 countries participated in 2003 PISA assessment and Turkey was in the 37th rank in science education. Continuous unsuccessful results of the international assessments for the Turkish education system urged that Turkey revise its academic curricula and come up with a new one in parallel with science education in the world. For this reason, Turkish Ministry of National Education decided to revise the curricula of primary education institutions, which undertake the responsibility of preparing individuals for life in addition to that of preparing them for a higher educational step, in order to catch up with the age and to raise more qualified individuals. The new academic curricula for primary education was designed by taking the constructivist approach adopted by many countries into consideration (the USA, Canada, England, Australia, New Zealand, Spain, Finland, Ireland, Israel, Austria, Singapore etc.) Then it

started to be implemented in primary education institutions step by step beginning from 2005-2006 academic years.

It is obvious that the adequate implementation of the new constructivist-oriented primary education curriculum in Turkey depends heavily on teachers. Therefore, the new educational curricula designed in accordance with the principles of constructivism, assign teachers new tasks, responsibilities and roles. In order for teachers to realize the roles mentioned above and to implement the curriculum successfully, they must be-well informed about the structure, philosophy and implementation of the curricula. However, several research findings point out that there are some problems about the implementation of the curricula in Turkey. The findings of the researches conducted in Turkey show that classroom teachers are certainly in need of an in-service training in terms of acquisitions, content, learning-teaching process, instructional technologies and material development, and measurement and evaluation dimensions in order to perform the implementation of the program properly. Besides it was also determined by these findings that there are some problems concerning the implementation of the new curriculum such as insufficient resources and equipment, limited time provided for experiment and research, the overwhelming tendency towards traditional methods. Research results also point out that the problems generally emerge in practical phase, particularly in designing learning environments (Yaşar et al, 2005; Erdoğan, 2005; Bozyılmaz & Bağcı-Kılıç, 2005; Saylan & Yurdakul, 2005; Özdemir, 2005; Selvi, 2006; Yücel et al, 2006; Çubukçu, 2006; and Batdal, 2006).

The design of learning environment is one of the most important factors for implementing the academic curricula effectively. New curricula of Turkey recommend taking student at the center of learning. According to new curricula, teachers are supposed to let students manage the lesson and change teaching strategies and content. It is expected from Turkish teachers to create an efficient communication environment between teachers and students, to ask thought-provoking and open-ended questions which promote students' natural curiosity, to value individual responses, to encourage discussions about opposing hypotheses and to allow students to establish relationships and create metaphors.

The success of the new primary education curriculum in Turkey depends heavily on conducting the researches which examine learning environments deeply, determine the existing problems and recommend efficient solutions for these problems and on designing applications in accordance with the results of these researches. The aim of this study is to determine the needs and problems of classroom teachers about designing constructivist learning environments and to state the practical suggestions concerning these problems.

METHOD

The research is designed based on document analysis, a qualitative research method. Documents analysis is a method that involves the analysis of printed materials containing information about the phenomena and events (Yıldırım & Şimşek, 2005). The documents obtained by one of the researchers from 94 teachers who participated in the workshop held by Ministry of National Education within the scope of SBEP project were used in this study as well. Through the "Support to Basic Education Programme", run by the Ministry of National Education, the European Union supports enhancing the quality of formal and non-formal education in Turkey as well as improving access to education. The Programme, with a budget of 100 million Euros funded by the EU, encompasses a broad range of activities covering various areas such as improving the primary education curriculum.

The steps followed while carrying out the research are listed below:

1. A total of 94 classroom teachers from 81 provinces who participated in the workshop aimed at designing constructivist learning environments in science education within the framework of SBEP project were included in the scope of this study. The teachers who attended in the workshop had at least ten years teaching experience. All teachers divided into groups consisted of five or six person. One of the researcher as a workshop lecturer paid attention to manage groups with the members who were coming from different provinces. So that it had been provided to work different persons together from different provinces. There were eighteen groups in total.
2. Within the scope the curricula one of the researchers gave a lecture to the teachers for two hours. Then, teachers were delivered booklets explaining the characteristics of constructivist learning environments. The booklets were consisted of 25 pages explaining the constructivist principles, teacher, student and other shareholder's roles, learning environment's features and how to arrange a constructivist learning environment. In accordance with the information provided in these booklets, were asked to evaluate their own learning environments in implicational phase of the new primary education curricula.. Firstly, teachers shared their own teaching experiences and then they explained their problems while they were implementing the curricula. They were discussed about possible solutions of the problems. all of the problems and solution

suggestions wrote down to the papers. After that teachers discussed and ranked the problems and solution successions according to priority rank.

3. Based on these evaluations, they formed group documents including their needs, the problems they run into and the practical suggestions they came up with. Each group presented their evaluation results to others and discussed their views.
4. Finally it was reached to eighteen documents from eighteen groups. These documents were collected and analyzed by means of documents analysis method.

Data Analysis

Descriptive analysis method was employed in data analysis process. Descriptive analysis is a method used in the researches in which the conceptual and theoretical framework is determined clearly beforehand. The research questions, the questions utilized in interview and observation processes or the dimensions in these processes are considered during the presentation of the data (Yıldırım & Şimşek, 2005). The analysis of research data were carried out in the following phases:

Writing down and evaluating the data: The documents collected from the groups were examined separately by each of the three researchers. Based on the relevant literature, a total of six themes – namely personal relevance, scientific uncertainty, shared control, student negotiation, critical voice and Attitudes towards Lesson – were predicated upon for this study (Taylor, Dawson & Fraiser, 1995; Taylor, Fraiser & Fisher, 1997; Aldridge, Fraiser, Chen, C. & Taylor, 2000).

Coding the data: The researchers coded the suitable themes by independently reading the forms where the data within the scope of the study was written. In situations where there were not any themes to mark, they formed another theme under "other" title for this data and performed the markings under that theme.

Comparing the coding and reliability: After coding the themes independently, the researchers compared the reliability of the coding keys. During the comparison, themes which included each question item and were marked by the researchers were controlled and the "agreement" and "disagreement" among the researchers were determined. If the three researchers marked the same theme or did not mark a specific one at the same time, this situation was considered to be an *"agreement among experts;"* whereas the situations where they marked different themes were considered as "Disagreement." The conciliation percentages were determined based on Miles and Huberman's (1994) formula. The result gained through this formula showed that there's 85% reliability. The 15% data on which the three researchers could not reach an agreement was placed into the existing themes with the consensus reached through the joint study by the researchers.

FINDINGS AND INTERPRETATION

The following findings were gained as a result of the data analysis. The problems determined by the teacher groups participating in the workshop are presented below.

Personal Relevance

Problems	f
Students cannot establish connections with what they learn at school and the outside world (the 4th, 5th, 10th and 13th groups)*	4
New learning does not start with the problems related to real life (the 2nd and 7th groups)*	2
What is learned at school is not related to real life directly (the 2nd group)*	1
Learning does not match with the realities of life due to the reasons such as dependence on the curriculum, lack of suitable examples compatible with the environmental conditions, complete obedience to the examples provided in the textbooks and inadequate knowledge about the philosophy of the curriculum (the 7th group)*	1
Science Course is not connected to the world outside the classroom sufficiently (the 12th group)*	1
Students do not know why they learn (the 4th group)*	1
The teacher faces a confusion caused by the former curriculum and the new one (the 18th group)*	1

* Groups are homogeneous. Each group has members from different regions but all teachers have at least ten years teaching experience.

The dimension of personal relevance could be defined as ensuring that students can relate what they learn in science courses to their lives and form knowledge constructions peculiar to them in their personal meaning worlds. (Moussiaux & Norman, 2003). In this respect, the problem stated as *"the fact that students cannot establish connections with what they learn at school and the outside world"* was considered to be a major issue by four groups (the 4th, 5th, 10th and 13th groups). This situation points out that the constructivist learning environments desired to be achieved through the new primary education curriculum cannot transfer outside life into the classroom and that knowledge is restricted to what is covered at school and in textbooks.

The problem stated by the 7th group as *"learning does not match with the realities of life due to the reasons such as dependence on the curriculum, lack of suitable examples compatible with the environmental conditions, complete obedience to the examples provided in the textbooks and inadequate knowledge about the philosophy of the curriculum"* and, another problem stated by the 18th group as *"the teacher faces a confusion caused by the former curriculum and the new one"* points out that teachers have not been able to adopt the philosophy of the new curriculum and they have had problems in the practical phase. The fact that the exam-oriented structure of Turkish Educational System has not changed yet could be a major reason for that. The fact that the exams are composed of multiple choice tests aimed at measuring knowledge rather than measuring the skills acquired by students through the curriculum leads to a clash between the requirements of the curriculum and the exams. As a result, misguided by parents' demands, teachers facing this dilemma tend to act in favor of exams.

Scientific Uncertainty

Problems	f
The fact that students cannot conceive how different people in different countries learn Science (the 5th and 11th groups)	2
The fact that students have difficulties due to the presence of the common absolute judgments about questionability of scientific knowledge (the 1st group)	1
The fact that people's values and opinions do not influence Science, in other words natural phenomena (the 2nd group)	1
Student role in questioning scientific knowledge (the 1st group)	1
Emphasis on absolute facts (positive knowledge) because of worries about catching up with the curriculum, exam anxiety and the pressure from the family and environment (the 6th group)	1
The fact that students are supposed to choose knowledge from a planned structure and therefore do not confront a complicated structure (the 9th group)	1

In contrast with positivist paradigm which highlights objectivity, constructivism in respect of educational philosophy argues that knowledge is interpreted (Yıldırım & Şimşek, 2005) and formed as a result of the mutual reflections and discussions. In other words, knowledge is composed of experience, observation and rational thinking; it is subjective (Bağcı-Kılıç, 2001). It is only natural that individuals living in different countries construct knowledge in different ways in relation with their cultural backgrounds and with the characteristics of the environment they live in. The problem stated as *"students cannot conceive how different people in different countries learn Science"* by the 5th and 11th groups indicates that teachers have difficulties in interpreting the subjective structure of the philosophy of constructivist approach.

Also, the problem stated as *"students have difficulties due to the presence of the common absolute judgments about questionability of scientific knowledge"* by the 1st group and another stated by the 6th group as *"the emphasis on absolute facts (positive knowledge) because of worries about catching up with the curriculum, exam anxiety and the pressure from the family and environment"* show that the dogmatic nature of Turkish Educational System has not changed yet. It could be suggested that the individuals who are prepared for life through multiple choice and only-one-truth exams at each level of instruction are bound to have difficulties in developing perceptions concerning the questionability of knowledge and that this is a factor handicapping their skills to question knowledge.

Critical Voice

Problems	f
The fact that students do not have the right to question how their own teaching is realized (the 11th and 14th groups)	2
The fact that students' critical thinking skills are underdeveloped (the 11th group)	1
Insufficient student participation (12th group)	1
The fact that students' tendency to complain increases due to their underdeveloped problem solving skills (the 8th group)	1
The fact that students do not have the right to criticize the teacher in every aspect (the 16th group)	1
The fact that students are not allowed to ask questions about the subjects within the teacher's responsibility (the 16th group)	1

Students in constructivist learning environments do their best to perform the tasks assigned to them within the group efficiently so that the group dynamics can be achieved. They evaluate group members and themselves objectively and are tolerant of any criticism levelled at themselves in the group (Yaşar, 1998). However, the problem stated by the 11th and 14th groups as *"students do not have the right to question how their own teaching is realized,"* and those stated by the 16th group as *"students do not have the right to criticize the teacher in every aspect*" and *"students are not allowed to ask questions about the subjects within the teacher's responsibility"* could be interpreted to mean that democratic teacher attitudes are still not pre-eminent in our country and a student-centred education is not practiced in our country.

Shared Control

Problems	f
The fact that students cannot assist the teacher in planning what to teach because they lack the relevant knowledge and do not know what they should know exactly (the 2nd, 5th, 8th, 9th, 12th and 17th groups)	6
The fact that students do not have the right to decide how much time to devote for the activities (the 2nd, 5th and 9th groups)	3
The fact that lesson objectives are not shared with students and students do not participate in lesson planning and time management because of teachers' underdeveloped democratic attitudes and behaviour (the 7th and 17th groups)	2
Student role in planning due to the ready-made curriculum, time-limits and teacher-centred understanding (the 1st and 14th groups)	2
Motivation and collaborative and active learning are not achieved (the 1st group)	1
Student role in the teaching of the teacher (the 1st group)	1
The fact that democratic culture supposed to be acquired through the new curriculum could not be achieved (the 18th group)	1
The fact that sufficient student participation in planning what to teach could not be achieved in practice because of the inadequate assumptions of the new curriculum about this issue (the 13th group)	1
The fact that teachers cannot involve students in planning since teachers are not well-equipped (the 6th group)	1

Considering the problems presented in the table, the problem stated by the 2nd, 5th, 8th, 9th, 12th and 17th groups as *"students cannot assist the teacher in planning what to teach because they lack the relevant knowledge and do not know what they should know exactly"* could be seen as an indication of the fact that the understanding that in constructivist learning environments, the teacher lets students direct their reactions, experiences, thoughts and interests into the lessons and change teaching strategies and content; encourages them to communicate with both him or her and among themselves; and steers them towards asking each other meaningful questions (Erdem & Demirel, 2002; Saban, 2003) has not been put into practice. Also, the problem stated by the 2nd, 5th and 9th groups as "students do not have the right to decide how much time to devote for the activities" and another one stated by the 7th and 17th groups as *"lesson objectives are not shared with students and students do not participate in lesson planning and time management because of teachers' underdeveloped democratic attitudes*

and behaviour" could be interpreted to mean that the principle of constructivist approach that students are allowed to determine their own objectives and to make preferences about the teaching techniques and content (Brooks & Brooks, 1993; Honebein, 1996; Windschitl, 2002; Akar & Yıldırım, 2004) could not been transferred into practical phase.

Student Negotiation

Problems	f
The fact that communication is not used for learning (the 13th and 18th groups)	2
The insufficiency of students' collaboration culture (the 12th group)	1

The interactive learning environments which can enable students to construct knowledge and meaning are vital for a meaningful learning environment. The problem stated by the 13th and 18th groups as *"communication is not used for learning"* and the other one stated by the 12th group as *"the insufficiency of students' collaboration culture"* could be interpreted to mean that teachers have difficulties in arranging constructivist learning environments and problems in creating interactive learning environments.

Attitudes towards Lesson

Problems	f
The fact that activities are not interesting (the 9th group)	1
The fact that students do not approach every lesson with the same willingness because of their different interests and motivation levels (the 17th group)	1
The fact that students do not enjoy some of the activities because ready-made activities are preferred (the 6th group)	1
The fact that teachers cannot provide students with complexity in reaching knowledge (the 2nd group)	1

The problem stated by the 9th group as *"activities are not interesting"* and another one stated by the 6th group as *"students do not enjoy some of the activities because ready-made activities are preferred"* could be interpreted both to mean that the principle of the theory that constructivist learning activities should be carried out in a way promoting active learning (Wilson, 1996) could not be adopted sufficiently and to mean that the resources provided to teachers are perceived as resources obligatory to use. It is vital in constructivist educational environments that learning resources be varied. The use of rich learning resources will increase student interest in the lesson and develop positive attitudes in the students enjoying the tasks they do (Brook & Brooks, 1993; Marlowe & Page, 1998).

Constructivist learning processes are supposed to be complicated (Yurdakul, 2005). However, the problem stated by the 2nd group as *"teachers cannot provide students with complexity in reaching knowledge"* could be taken as an indication of the fact that teachers are not able to understand this principle adequately.

CONCLUSION AND RECOMMENDATIONS

According to the research results, the problems emerging about the theme of personal relevance are the facts that what is learnt in the classroom cannot be associated with the real life and that learning activities cannot be designed in accordance with the real life problems. The principal reason for the problems listed under personal relevance theme could be the inefficiency of teachers in Turkish educational system to provide their students with the environments where students can seek solutions for real life problems and to manage the teaching-learning activities in this environment. The results of the research conducted by Beck (1997) revealed that teachers' behaviors have the force to affect performing the phenomenons such as personel relevancy, scientific uncertainly, shared control, student negotiation, critical voice and attitudes toward lesson. It is advisable in constructivist learning environments to prepare activities which make it possible for students to have real-life related experiences and which require problem-solving and to make use of problem-based learning method. It could be suggested, however, that an academic curriculum, a course book and companion guides designed in a centralist approach prevent that. Designing resource books and teacher's books which are compatible with the local life conditions may be a contribution to the solution of this problem. Another recommendation for the solution might be carrying learning activities out of the classroom so that students can have real-life related experiences.

The most noticeable one among the problems emerging under the heading scientific uncertainty is the fact that students experience some problems in interpreting Science and questioning knowledge. It could be argued that this problem derives from the exam-oriented structure of the Turkish Educational System. No matter how hard the curricula designed try to put the student in the centre, the worries emerging during the preparation for the qualifying exam system at the end of primary education prevent implementing the curriculum and manipulate instruction into memorizing education which praises only one correct answer. As a solution for the problem, students' ideas should be welcomed without making any judgments and the reasons underlying such responses be examined in learning environments. In this process, students should be directed thought-provoking questions and discussion environments should be created.

The statements that students have no right to question their own teaching process is conducted and that their critical thinking skills are not developed are noticeable among the problems under the heading critical voice. It could be suggested that these problems are caused by the transition from an educational system in which the teacher has been seen as the only authority contrary to learning environments where responsibilities for learning are shared between the teacher and student. It is quite natural for students to go through some difficulties in expressing themselves because they just move from family authority to the school authority and cannot develop critical thinking and self-expression skills. Aldridge at all (2000) compared Taiwanese and Australian high school students view's according to constructivist learning environment survey. The research results showed that cultural factors affected student responses. Students in Taiwan appeared to have a higher regard for their teachers than Australian students and were therefore less likely to criticize them. These results are associated with the results of this research. In order for students to develop critical thinking skills communication patterns should be developed where students are asked questions such as "what do you think about this subject?", "why do you think so?", "how could you reach to that conclusion?". In this way, students get the opportunity to put forward their interests as well as to argue based on their weaknesses and strengths. Also, redesigning sitting arrangement and physical environment of the classroom in a way that that enhances communication could help solve this problem.

The problems under the heading shared control are similar to those under the heading critical voice. It could be argued that the limited technologic facilities of schools and the insufficiency of resources sometimes make it impossible to apply the activities required by the constructivist theory and to let students manage the process. The results of Yılmaz's (2005) research put forward those teachers having some problems on teaching science and technology course. These problems are classifed as the lack of equipment, not having enough practice, time problems, crowded classrooms and not having well equipped laboratories. Our research results are associated with Yılmaz's research results as well.

Moreover, the fact that textbooks were prepared without providing technical equipment which facilitates the implementation of the constructivist theory in educational environments obscures receiving student opinions to determine the activities to be performed and may lead to a return to the traditional methods. Among the practical suggestions are improving the technological equipment and physical conditions at schools in accordance with the requirements of the constructivism, providing students with the resources and equipment which make it possible for them to make researches and increasing school-parents collaboration so that students receive extra support at home. Designing activities through which students can make researches individually or in a group will contribute to shared control and help students acquire a critical perspective.

It can be argued that the problems stated under the heading student agreement are caused by the fact that teachers are not able to manage the classroom environments required by the curriculum. We might assume that this situation derives from expecting teachers to apply the curriculum properly without first training them. The findings of the research conducted by Yaşar et al (2005) showed that classroom teachers are certainly in need of an in-service training in order to implement the program properly. Providing teachers, who are the chief components of the system, with an in-service training that will help them grasp the philosophy of the constructivist approach and its applications could be useful as a solution for the problem. Similarly, Marra's (2005) research results exposed that instructors' epistomologies have an impact on designing constructivist learning environments. Schools and universities should cooperate and teachers should become involved in case studies with the support from expert researchers so that they improve themselves professionally.

The problems stated under the theme developing positive attitudes in students towards lesson are also caused by the fact that teachers are not able to arrange the learning environments required by the constructivist activities. The results of Ogbuehi and Fraser's (2007) study revealed positive associations between learning environment and students' attitudes. Students, who cannot study in interactive classroom environments and who don't get any pleasure from the activities performed only because they are covered in textbooks, naturally do not like the

lesson. The reasons such as those parents do not support schools in terms of physical conditions and non-school tasks hinder arranging group works. In addition, an exam-oriented educational system and other reasons mentioned above prevent students from developing positive attitudes towards Science and Technology course. Presenting students with the opportunity to work in groups will develop mutual respect and communication skills as well as helping develop notions such as respecting individual differences, developing self-confidence and developing positive attitudes towards the lesson. Providing a variety in learning resources in learning environments plays a key role in developing positive attitudes. A teaching process supported with various resources will be more attractive and permanent learning will be assured by addressing to different sense organs. Finally, setting a positive classroom atmosphere and providing space for the activities that will make it possible for students to learn through hands-on experiences could also be suggested among the ways to ensure that students develop positive attitudes towards the lesson.

Continuing with the textbook-centred education is among the major reasons of the problems. Educational settings that will yield an authentic learning process in a natural environment should be created. In order for the constructivist education approach to be implemented in Turkey properly, uniform notion of schools should be left and a school setting which reflects the real life needs to be created.

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