NEEDS ASSESSMENT STUDY IN SCIENCE EDUCATION: SAMPLE OF TURKEY[1)]

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Abstract. A needs assessment process was conducted to determine the difficulties and requirements of a science unit as an example how needs assessment process can be used in science education in Turkey. A 40-item teacher questionnaire containing four dimensions related to a chemistry unit named "*Travel to the Inner Structure of Matter*" as presented in the current curriculum materials was administered. The questionnaire was completed by 130 elementary school science teachers in order to get their views and suggestions for revising the unit**.** The Cronbach's alpha reliability coefficient was found to be .93 for the questionnaire. Descriptive statistical methods were also used in analyzing the survey data. It was concluded that science teachers recognize some deficiencies in the unit's aims and goals, teaching program, teaching strategies, and evaluation procedures. As a result of this study, it is suggested that instructional designs and revisions of existing materials for science units can be undertaken using a deliberate needs assessment process–in particular a process that –relies both on the existing research related to a topic and teachers' expert input regarding instruction.

Keywords: needs assessment, instructional design, science education, matter

Introduction

Instructional design is a systematic process aimed at helping students learn more easily. The process generally consist of four steps; analysis, development, implementation, and evaluation (Dooley, 2005). McArdle (1991) suggested that the most important step of the instructional design is planning, which includes formulating the learning objectives, analyzing

the training situation, outlining the body, and determining the method, sequence, and instructional approach to be used. In the planning step a thorough needs assessment is a critical component of the design process and a tool for program planning.

Kemp et al. (1998) defined the "needs" in an instructional situation as a gap between what is expected and the existing conditions (see also Dick et al., 2005). According to Kemp et al. (1998), there are four phases to conducting a needs assessment; planning, collecting data, analyzing data, and preparing the final report. In the planning phase, a strategy is developed for collecting the needs data by using varied data collection methods such as questionnaires, rating scales, interviews, small-group meetings, and reviews of paper trails. In the second phase, factors determined in the planning phase to be important with respect to reliability and validity such as sample size and distribution should be taken into account as data are collected. In the third phase, data analysis, collected data must be scrutinized and explored using qualitative and/or quantitative approaches. In general, needs assessment results are reported as frequencies, but may also be descriptive in nature. In the final phase, preparing the final report, the researcher should include these sections; (a) summarize the purpose of the study, (b) summarize the process of the study by explaining the procedures and describing the participants, (c) summarize the results with tables and a narrative explanation, and (d) make the necessary suggestions based on the data. Dick et al. (2005) also stated that needs assessment procedure includes three steps: (a) what is the problem; (b) how do we solve it; and (c) determine the exact nature of an instructional problem and how it can be resolved. McArdle (1998) has suggested a different needs assessment procedure including four steps; surveillance, investigation, analysis, and reporting. In each step, specific activities are undertaken:

Surveillance–Determine the current situation and identify changes by observing the situation closely, especially to see if a performance-related problem exists.

Investigation–Gather data to establish whether training is an appropriate response. These data will also provide the foundation upon which an effective training program can be built.

Analysis–Undertake an assessment that provides a clear understanding of the problem, with careful attention to ensuring quality evidence and data sources. Three types of analyses are possible, which may be related to goals, the organization, and specific jobs.

Reporting–The training design report, which is one of two general types of reports, summarizes the investigation and analysis findings, presents recommendations, and suggests materials the training manager should use for each stage of the project. The other report type, the final report, identifies performance gaps and what needs to be changed, how changes will be made, and how the changes fit into the organization's goals.

When the needs assessment studies were examined in science education in Turkey, it was seen that there are many recent studies evaluating aspects of general science curricula. This study was implemented to apply a rigorous needs assessment process with the goal of determining of the needs of one specific unit; "Travel to the Inner Structure of Matter" within the *2000 Science Teaching Program (STP)*. This unit was selected for several reasons. First, there are many recent studies related to the topics in this unit in terms of incorrect understandings that are typically held by students, and challenges teachers face when teaching the unit's topics (Özdilek, 2006). Second, it was seen that this unit was changed in the last 30 years in terms of aims, goals, and class level. This situation can be seen another indication about the problems of the unit. Finally, subjects of the unit occupy an important place in the science teaching program in the sense that they are necessary to better comprehend several other subjects in elementary general science courses and secondary chemistry courses. For these reasons, it is aimed that applying a detailed needs assessment process for determine the challenges that came out of from *Travel to the Inner Structure of Matter* unit in science education.

Content of the unit according to *Science Teaching Program*

The unit entitled "*Travel to the Inner Structure of Matter*" (hereafter called "the unit") that is found in the *STP* is a chemistry unit at the seventh grade. The suggested teaching time for the unit is given to be nine to ten weeks in the annual plan. In this science teaching program the presumed time science instruction is 3 lesson-hours per week. Thus, the recommendation is that the teaching of the unit is intended to be done in 24 to 27 lesson-hours just as it was defined in the annual plan. The unit's sections and goals related with the topics are shown in Table 1.

Table 1. *Topics and goals of the unit with their original numbers as they are in the STP*[2)]

Section A. Classification and transformations of matter	
Topics	**Goals of the Unit according to the topics**
Classification of the matter as solid, liquid, or gas	1) Classifies the matter by giving examples and describing the differences among them; 2) Describes the density and densities of different matter and compares them by doing experiments
Chemical and physical changes	3) Explains physical and chemical changes by doing experiments
Separating mixtures by physical processes	4) Explains mixture types with examples from daily life; 5) Determines solute and solvent by preparing various solutions types; 6) Separates mixtures with appropriate methods and gives examples from the areas where these methods are used
Separating compounds by chemical processes	7) Demonstrates the methods of separating compounds and gives examples from the areas where these methods are used
Matter is composed of the elements	8) Demonstrates with the experiments that some of the pure substances could not transform to more simple substances; 9) Explains the differences between structure of elements and compounds and gives examples; 10) Shows the events by which compounds are formed from elements with the experiments; 11) Explains of the elements' symbols by giving examples
Section B. Structure of the atoms and periodic table	
Structure of atoms	13) Explains the structure of matter with nucleus and energy levels; 14) Calculates the number of subatomic particles such as protons, neutrons, and electrons by using atomic number and mass number;
Ions are charged forms of atoms	15) Explains the formation of ions by giving examples
An element can have more than one isotope	There are not any goal about the topic
Elements can be classified by their properties	12) Explains the specific features of metals, nonmetals, and semi-metals by giving examples
All of the elements are shown on the periodic table	16) Specifies the names of first twenty and some other most-used elements that are found on the periodic table and shows the elements by using their symbols; 17) Specifies the means and importance of the periods and groups that are found the periodic table

Studies about the Turkish *STP* and the unit

Several studies have considered the organization of the *STP* in Turkey. Some of the researchers found that despite science teachers knowing that there had been changes in the science curriculum, they could not explain the differences between the old and new aims of the curriculum and instructional approaches to be used[3,4] (Karamustafaoğlu, 2003). This suggests that teachers require explicit information about the development of the materials, techniques of laboratory instruction, and the rationale for the approach taken. Also, teachers do not have the necessary knowledge and skills for applying experiments and class activities according to a constructivist approach.[3-5] This information is given in terms of how the new materials can be used as a better guide for learners. The researchers specified that in the light of these findings, science teachers do not have the necessary skills and knowledge to put the curriculum into practice as intended by the developers. Thus, the curriculum could not be implemented properly in classrooms. Also, Savran et al.[6] stated that this program does not have adequate features in terms of problem solving skills and use of scientific method. For this reason there are too many requirements to the guide books for both teachers and students to work with effectively[4,5] (Akpınar, 2002).

Savran et al.[6] emphasized that the most important problems about the *STP* are the inadequacy of science textbooks and materials, and the insufficiency of their presentation. Importantly, various studies have found that the instructional materials based on the *STP* are inadequate in terms of several features. Also, the materials based on the *STP* are not sufficient in terms of visual items such as graphics, pictures and figures.[7] Köseoglu et al.[8] concluded that science textbooks based on the *STP* are not effective for science teaching and are not prepared according to a constructivist approach.

Semenderoğlu[9] stated that, there are too many detailed topic within the science units, even though the number of units was reduced in the *STP*. As well, Semenderoğlu[9] and Karamustafaoğlu (2003) suggested that learning differences related to the speed by which different students acquire various concepts. And, the capabilities of students were not considered for some topics. In addition to these common points Bayrak & Erden (2007) have found several weaknesses following included the findings: (a) explanations in the texts are not sufficient for learners to understand the topics; (b) experimental setups did not have features needed to guide students' preparation easily; (c) tools and equipment provided to students are not sufficient; (d) objectives and goals in the program are not consistent with the topics and do

not appropriate for students' levels, and (e) explanations of the evaluation and measurement are not sufficiently detailed.

A very limited number of studies including attention to the unit titled "*Travel to the Inner Structure of Matter.* Nakiboğlu & Benlikaya (2001) stated that not all of the goals are appropriate for the units' objectives. Topics were not organized according to their principles of prerequisite, and do not progress from more simple to more complex. For example, the "structure of matter" topic which is found on the 4th grade and is, therefore, after the "states of matter", will be more appropriate if it were taught after the compounds and elements topic at the seventh grade. Also, the curriculum does not include activities that can be done outside of the class. There are not any special teaching methods and strategies for the topics, and there are not any direction provided as to how to use unit's materials especially on the chemistry units. Assessment has also been an issue in the *STP.* Yiğit & Akdeniz[10] found that science teachers were not able to prepare examination questions about the concepts in the unit, so assessments are not adequate with respect to their content reliability.

Karamustafaoğlu (2003) stated that students have important challenges in terms of understanding some of topics of the unit. But these are not apparently taken into account in the design of the curriculum units. And, the goals of the unit are not attained by learners because the teachers could not use the given experiments in existing classroom conditions. And, there are not adequate tools and materials about the unit in laboratory at schools. Also Karamustafaoğlu (2003) and Karamustafaoğlu & Üstün[11] stated that suggested time on the annual plan for the unit was not adequate.

Several researchers emphasized that seventh grade textbooks which also have the unit we focus on have some difficulties. Karamustafaoğlu & Üstün[11] suggested that there are not any alternative assessment tools in the textbooks. Dökme[7] stated that the units in the 7th grade textbook did not provide activities sufficient for the purposes of developing and reinforcing students' science process skills such as predicting, classification, and communicating.

In response to the issues with the curriculum and instructional materials found by the studies cited above, the purpose of the current study was to collect more detailed information about how to revise the unit. This study also set about to determine teachers' views on the revisions they thought would be beneficial in the unit. It is believed that in addition to the information sources used in the studies, the expertise of teachers who have undertaken instruction in this content is a valuable focus of investigation, yielding use-

ful information about this unit, and the science curriculum more generally. For this reason, the application of needs assessment procedure has been limited by the science teachers' views in our study.

Purpose

The purpose of the study was to conduct a needs assessment using various sources of information, including by determining science teachers' views in relation to the unit, as part of the science course in response to the *STP* in Turkey. The following research questions guided this study:

1. What are the needs of the dimension of appropriateness of the goals and objectives, teaching curriculum, teaching strategies, and evaluation according to the science teachers' views?
2. What are the other suggestions of science teachers about the unit?

Method

This study involved undertaking multi-faceted needs that were designed to incorporate the results of several studies, as well as engage teachers in providing input based on their experience with the unit. Specifically and the topic covered in the unit in general. The needs assessment steps included the following:

1. After the examination of STP used previously in Turkey to find problems that had been reported, the unit under study was examined to assess those same areas;
2. A measurement tool (questionnaire) was developed to solicit teachers' opinions regarding the unit, including how effectively it supported conceptual development, scientific skill development, higher order thinking skills and other dimensions;
3. Measurement tool was implemented by having science teachers respond to the survey;
4. The collected data were analyzed by appropriate statistics methods;
5. The analyzed data were used as the basis of comments and recommendations regarding instructional problems in the unit and how those might be addressed through revison.

Sample

Participants in the study were 130 in-service science teachers (56.9% male and 43.1% female) who teach from 6 to 8 grade levels from 68 randomly selected elementary schools in the city of Bursa. Teaching experience of the participants was analyzed in incremental categories; between 0–5 years (8.5%), 6–10 years (11.5%), 11–15 years (21.5%), 16–20 years (6.9%), 21–25 years (36.9%), and 26–30 years (14.6%). In the semester prior to this study, all teachers had instructed students using this unit in general education classrooms. All of the participants reflected a willingness to fill out the measurement tool of teacher views regarding the unit.

Measurement tool

Teachers' views questionnaire was developed by the researchers in order to determine the challenges inherent in the unit by discussing the science teachers' views. To develop the questionnaire, the opinions of two experts–an assistant professor at educational sciences department and a science education professor–were taken into consideration to ensure the content validity of the test items. The educational sciences expert had 12 years of experience, while the science professor had 32 years of teaching experience. This study was piloted on 30 science teachers who served at schools other than those used in the study. The questionnaire was comprised of 40 Likert-type and an open-ended item. After the pilot study, the Cronbach's alpha reliability coefficient of the questionnaire was found to be .93 in the study by the researchers. The questionnaire also indicated a high level of agreement regarding what was needed.

The questionnaire included 40 items designed to assess specific aspects of the unit materials and their use; (a) 9 items for appropriateness of the unit's goals and objectives, (b) 15 items for the teaching program, (c) 11 items for the instructional strategies, and (d) 5 questions for evaluation. Each item was responded to using a scale of 1–5 (1 = Not ideal, 2 = A little ideal, 3 = Medium, 4 = Ideal, 5 =A great ideal). Consequently possible overall scores given to the unit by the teacher participants' could range from 40 to 200. The items in which teachers gave no opinion were evaluated as unanswered. Each item was evaluated according to the 1-5 level (1 = Not ideal if the item's mean score ranged from 1.00 to 1.80; 2 = A little ideal if the item's mean score ranged from 1.81 to 2.60; 3 = Neutral if the item's mean score ranged from

2.60 to 3.40; 4 = Ideal if the item's mean score ranged from 3.41 to 4.20; and 5 = A great ideal if the item's mean score ranged 4.21-5.00.

Procedures

Science teachers were informed of purpose of the study verbally and through directions before they filled out the questionnaire. After they had completed the questionnaire, they were asked to respond to the open-ended question; "Please state your recommendations regarding if you think that changes are needed to the *STP* unit called "Travel to inner structure of matter".

Data analysis

The data gathered from the teacher questionnaire were analyzed with descriptive statistics involving percentages, and mean average by using SPSS 11.00. Open-ended responses were evaluated according to the dimensions of the questionnaire; appropriateness of the unit's goals and objectives, teaching program, instructional strategies, and evaluation resources. Open-ended responses were coded by the researchers by taking into consideration if the answers are similar. Then, the frequencies and percentages of the same responses were calculated.

Results

Results are organized according to four dimensions of the unit that were mentioned earlier. It was concluded that there was a need for revision related the item, if the item's mean average ranged from 1.00 to 3.40 and/or the percentage of responses at the medium (M) level (i.e. a little ideal (AI), and not ideal (NI) levels were greater than the ideal (I) or great ideal (GI) levels. Detail information will be presented in conclusion section about the items that showed a need for improvement. The mean average and percentage of the items, thus indicating a need for improvement can be summarized as follows.

Dimension of the appropriateness of the unit's goals and objectives

Descriptive statistics related to science teachers' views on this dimension indicated that certain items for example; 1, 4, 5, 6, 8, and 9 showed a need for improvement. Means and percentage of the levels for each item are presented in Table 2. It can be seen that the most dramatic findings arise on the items 4 and 9, for which the percentages of "medium" level were quite a bit greater than the "ideal" level, as can be seen below.

Table 2 . *Teacher views on the dimensions of the unit's goals and objectives*

Item	N	x	GI%	I%	M%	AI%	NI%	Conclude
1	130	3.47	10	38.5	40	11.5	0	Ideal
2	128	3.65	11.7	50	30.5	7	0.8	Ideal
3	124	3.7	12.9	50.8	29	7.3	0	Ideal
4	127	3.35	11.8	29.1	42.5	15	1.6	Medium
5	123	3.37	9.8	35.8	39.8	11.4	3.3	Medium
6	130	3.47	14.6	33.1	37.7	13.8	0.8	Ideal
7	130	3.7	18.5	43.1	29.2	8.5	0.8	Ideal
8	127	3.2	15	26.8	27.6	25.2	5.5	Medium
9	120	3.34	6.7	33.3	49.2	9.2	1.7	Medium

Note: GI: Great ideal, I: Ideal, M: Medium, AI: A little ideal, and NI: Not ideal

Dimension of the appropriateness of the unit's teaching program

Science teachers showed that there was a necessity a large extent on the items such as 10, 13, 14, 15, 16, 17, 19, 21, 22, 23, and 24 to improve about the unit's teaching program. The results related the dimension of unit's teaching program are presented in Table 3. From the answers provided above there are too many needs for revision determined on this dimension accord-

ing to the science teachers' perceptions. The most pronounced needs can be seen on the items 15, 21, 23, and 24, because of the items on the medium level's percentages are rather higher than the percentages of ideal level.

Table 3 . *Teacher views on the dimensions of the unit's teaching program*

Item	N	x	GI%	I%	M%	AI%	NI%	Conclude
10	128	3.36	11.7	32	38.3	16.4	1.6	Medium
11	129	3.62	19.4	38	28.7	13.2	0.8	Ideal
12	130	3.22	9.2	29.2	39.2	18.5	3.8	Medium
13	129	3.39	10.9	35.7	37.2	14	2.3	Medium
14	125	3.12	8.8	30.4	31.2	23.2	6.4	Medium
15	129	3.15	7.8	25.6	45	17.1	4.7	Medium
16	129	3.33	10.9	41.1	37.2	10.1	0.8	Medium
17	127	3.2	9.4	37.8	20.5	27.6	4.7	Medium
18	127	3.44	15.7	28.3	41.7	12.6	1.6	Ideal
19	126	2.6	11.9	15.9	14.3	35.7	22.2	A Little Ideal
20	127	2.75	12.6	20.5	16.5	29.9	20.5	Medium
21	127	3.17	7.9	28.3	43.3	14.2	6.3	Medium
22	129	3.28	10.9	31	38	15.5	4.7	Medium
23	127	3.12	9.4	21.3	46.5	17.3	5.5	Medium
24	129	2.33	7	10.1	17.1	41.1	24.8	A Little Ideal

Dimension of the appropriateness of the unit's teaching strategies

It can be seen that there is a need on the items 25, 26, 27, 29, and 30.The most indicative items of a need for revision are 25, 27, and 30 (see Table 4). The reason for that almost half of the teachers stated that these items were categorized on the medium level.

Table 4 . *Teacher views on the dimensions of the unit's teaching strategies*

Item	N	x	GI%	I%	M%	AI%	NI%	Conclude
25	130	3.22	6.2	31.5	41.5	19.2	1.5	Medium
26	130	3.3	6.2	36.9	39.2	16.2	1.5	Medium
27	130	3.15	2.3	33.1	46.2	13.8	4.6	Medium
28	128	3.46	11.7	34.4	44.5	7	2.3	Ideal
29	128	3.4	10.2	37.5	38.3	10.2	3.9	Medium
30	127	3.2	7.9	26	47.2	15.7	3.1	Medium
31	129	3.45	13.2	33.3	41.1	10.1	2.3	Ideal
32	130	3.38	14.6	33.8	33.1	12.3	6.2	Medium
33	125	3.28	9.6	33.6	37.6	13.6	5.6	Medium
34	127	3.32	9.4	34.6	38.6	13.4	3.9	Medium
35	126	3.31	8.7	29.4	48.4	11.1	2.4	Medium

Dimension of the appropriateness of the unit's evaluation

The results revealed that there are requirements on almost all of the items on the evaluation dimension except the item 36 (see Table 5).

Table 5 . *Teacher views on the dimensions of evaluation*

Item	N	x	GI%	I%	M%	AI%	NI%	Conclude
36	129	3.48	10.9	40.3	36.7	10.9	1.6	Ideal
37	129	3.38	8.5	43.4	27.9	18.6	1.6	Medium
38	127	2.89	4.7	22	35.4	33.1	4.7	Medium
39	130	3.00	3.8	23.8	43.8	25.4	3.1	Medium
40	130	2.71	3.8	14.6	40	31.5	10	Medium

Science teachers' suggestions about the unit

Based on the analysis of the open-ended responses, frequencies and percentages showed that several areas need improvement as mentioned above. Most of the science teachers suggested that: 1. Experiments in the unit should be made more interesting to students and the number of the experiments must be increased (f = 35, 85.3%); 2. Equipment suggested in the unit should be focused on common items so they can be more easily found (f = 32, 78.0%); 3. A more constructivist approach including the use of concepts maps should be used in the unit (f = 31, 75.6%); 4. The time allowed for the unit in the annual plan must be raised (f = 28, 68.3%); 5. Evaluation questions for the unit must be comprehensive (f = 27, 65.9%); 6. Examples that are found in the unit should be more effective (f = 23, 56.1%); 7. Pictures of science textbooks must be more interesting (f=23, 56.1%), and 8.Unit's objectives and goals are difficult for the students level (f = 20, 48.8%).

Conclusions

Findings of the present study will be discussed generally based on the studies which were about *STP* in Turkey, for there are very limited studies about the specific unit that was mentioned before. It was concluded that science teachers recognize some deficiencies in the unit's aims and goals, teaching program, teaching strategies, and evaluation procedures. These findings will be discussed separately in the following sections.

Unit's goals and objectives

Science teachers suggested that the unit's goals and objectives did not have features that help students to gain basic knowledge, scientific skills, and practice about daily life. Nor did they believe the unit encouraged students' use of scientific method. In addition, the students were not able to effectively learn the concepts of the unit. Also, the science teachers suggested that some goals need to be added to the current goals, and that the unit's goals were not appropriate for the learners' current levels of understanding. These results are consistent with the findings of Savran et al.[6] and Dökme.[7]

It is thought that the finding from the questionnaire that "some goals need to be added to the current goals" is well advised since the topic of "an element can have more than one isotope" was in the unit, there was not any goal

about this topic can be seen in Table 1. In addition, it can be seen that there is some repetition and/or overlap in the goals, such as between goal 11 (i.e. Explains the elements' symbols by giving examples) and goal 16 (i.e. Specifies the names of first twenty and some other most used elements that are found in the periodic table and shows the elements by using their symbols), which are obviously very similar. For this reason the goals of the unit must be reviewed, clarified and made distinct so that they can be effectively evaluated.

The finding that "the unit's goals do not ensure the effective learning" is compatible with the finding of Özdilek (2006) that when learners received the instruction on the unit by using the activities in the science course according to *STP*, students were learned the objectives at a quite low level. The other important finding is that the students could not learn the unit's objectives easily in the existent conditions. These weaknesses may be caused by several reasons as indicated in the literature[3,4,7] (and also Karamustafaoğlu, 2003 and Bayrak & Erden, 2007).

The finding that "the unit's goals are not appropriate for learners' levels" is consistent with the findings of Karamustafaoğlu (2003) that structure of atom and periodic table topics' do not match the seventh grade learners' cognitive levels. Moreover, science teachers stated that students have some conceptual challenges understanding of the topics of metal, non-metal, semimetals, homogeneous and heterogeneous mixtures, physical and chemical changes, electrolysis, and elements and compounds. This means that students are unlikely to succeed in much of the unit's content.

Unit's teaching program

The study findings suggest several problems with the unit's organization. For example, it was found that the unit was not organized in a way that is learner-centered, As well, the unit was not designed to improve the students' awareness of experimenting and observing skills, nor did it prompt learners to think at higher levels. And, the unit did not encourage independent and critical thinking, partially due to the fact that it was not found by students to be engaging. Also, there were some unrelated topics in the unit, and the unit's goals were not clearly consistent with the topics, definitions and concepts presented in the unit. Topics were not organized according to their prerequisite principles. Specifically, the development of ideas does not progress from close to out of reach, from concrete to discrete, and from simple to complicate. Finally, the suggested time on the annual plan for the unit

is not adequate, given the difficulties cited above. Some of these findings are also related to those of Nakiboğlu and Benlikaya (2001), Genç & Küçük[4] and Bayrak & Erden (2007). Especially majority of participants viewed that "suggested time on the annual plan for the unit is not adequate" is similar with[11] and Karamustafaoğlu (2003).

Unit's teaching strategies

According to science teachers, the following conclusions were found out on this dimension: (a) The unit does not have activities that help learners' cooperation with their peers; (b) the experiments and strategies suggested in the unit do not help learners' understanding of the topics (c) the unit is not ensure active learning and individual differences, and (d) tools and equipments suggested in the unit need to be easily found. These findings are similar with those of[6] and Karamustafaoğlu (2003).

Unit evaluation

The results indicated that the unit's measurement and evaluation processes did not take into account the unit's goals. Specifically, there were not any adequate number of questions in the unit, nor were there questions with which students would be able to evaluate themselves. Observation protocols suggested in the unit are not adequate to evaluate the unit's goals. These findings are compatible with[10] and Bayrak and Erden (2007).

Discussion

The main argument of the study is that science teachers recognize many deficiencies in the current unit's aims and goals, teaching program, teaching strategies, and evaluation process. However, the *STP* (*Science and Technology Program*) was completely changed with the initiation of the *STTP* (*Science and Technology Teaching Program*) by the Ministry of National Education in Turkey.[12] In the new curriculum many of the changes were seen as constructive. For example, the name of the "science" course was changed to "science and technology". The program was designed to emphasize the students' critical thinking, a constructivist approach to instruction, development of scientific literacy, encouragement of lifelong learning, inclusion of issues

that integrate the dimensions of a Science-Technology-Society model, and utilization of alternative evaluation approaches and learners' differences. Other changes were also seen as beneficial, such as a change in the weekly course duration from three hours to four hours. With the *STTP* program, in addition to science textbooks, student study books and teacher guides also were provided. In general, whereas the *STP* was too comprehensive, lacked focus, and did not emphasize teaching and learning activities (i.e. it was based on memorization rather than conceptual understanding), the *STTP* has been prepared on the basis of a constructivist approach and the use of collaborative learning, taking into consideration students' developmental level, and activities focused on content comprehension, as well as having assessment activities that allow students to think and make open-ended comments (Şahin Pekmez & Taşkın Can, 2007).

Several important changes also were made in the new program, especially with respect to the unit on which this research was focused. First, although the current unit was considered to fit in the 7th grade in the previous curriculum, the topics of the unit were spread among the grade four to grade eight levels according to STTP. Second, the course hours were increased from 27 to approximately 80 course hours. Third, the number of the goals of the unit was increased from 17 to 90. Finally, the number of activities was increased from 19 to 65. These changes and improvements apparently have met some of the needed alterations called for by the teachers in this study. These identified needs are; teacher guides and student study books, more time for the unit, improved appropriateness of content for the student developmental level, and increased focus on developing students' critical thinking abilities, and opportunities for problem solving.

However, it is seen from the studies in this area that researchers have mostly focused on the issue from a wider angle instead of only from a unit-based perspective (Şahin Pekmez & Taşkın Can, 2007; Yapıcı & Leblebiciler, 2007; İzci, Özden, & Tekin, 2008). In the current study, however, more detailed information about a unit was gathered. Therefore, it is expected that this study will be helpful to researchers and program developers who study instructional design and curriculum development. The study is focused on using a needs assessment procedure which integrates various models by several researchers. Thus, it can be used as a model of how needs assessment procedures can be applied to curriculum revision processes. Also, the study shows that, in addition to innovations in science and developments in educational domain, previous curricula should be considered in the process of instructional design and curriculum development. This is because

an examination of the previous programs is very important to determine the challenges and to not repeat the same mistakes and/or perpetuate the same problems (Özdilek, 2006).

Recommendations

This study's findings offer guidance for the revision of several dimensions of the curriculum, even as applied in the current *Science and Technology Teaching Program (STTP)*. As discussed earlier, further studies should be conducted on the changes needed to see whether or not they were thoroughly and adequately addressed for the unit in the *STTP*. More specifically, the following factors are provided as offering guidance to instructional design:

1. Whether or not the unit's aims and goals are appropriate for learners' levels;
2. Whether or not, in past implementations, the unit's goals and objectives were gained by the learners in sufficient level;
3. Whether or not the suggested time for the unit on the annual plan is likely to be adequate;
4. Whether or not teachers' guides books and science textbooks are sufficient for both teachers and students;
5. Whether or not the recommended instructional activities really fit with a constructivist approach;
6. Whether or nor suggested experiments help learners develop habits of cooperation with other learners as students develop their understanding of the topics.

Notes

[1] This study is compiled from the first author's doctoral dissertation entitled *Instructional Design of the 'Travel to Inner Structure of Matter Unit' within the Science Course in Primary Education* which has been defended at the Institute of Social Sciences of Uludağ University under the supervision of Prof. Dr. Muhlis Özkan.

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