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An Evaluation of Elementary Education Science and Technology Curriculum in Turkey from the Aspect of Integrated Teaching Approach*

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Abstract: In this research, the appropriateness of the 4th and 5th grades Science and Technology curriculum with integrated teaching approach was evaluated through interview techniques and document examination- a qualitative research technique. 20 teachers who were selected through accessible case sampling were interviewed in relation to the 4th and 5th grade Science and Technology curriculum, which was examined on the basis of relating to other courses and relating to intermediary disciplines. The data obtained from document examination were made numerical, tabulated and thus interpreted. On the other hand, descriptive analysis was performed on the data drawn from the interviews. The research findings reveal that there are problems in associations with other disciplines and with intermediary disciplines in the curricula for the 4th and 5th grades Science and Technology courses. Based on the data coming from interviews with teachers, it was found that teachers did not usually consider the objectives of intermediary disciplines while preparing their plans and that they had difficulty in relating course objectives to some intermediary discipline objectives.

Key words: Science and Technology curriculum · Integrated teaching approach · Intermediary disciplines

INTRODUCTION

The importance of interdisciplinary teaching in causing meaningful and effective learning in students is emphasized increasingly both in the literature and in schools. Teacher education programs attempt to explore ways to integrate different subject areas in a meaningful way to prepare their students as future teachers so that they themselves can utilize the same approach in their teaching practices in schools. Interdisciplinary approach is viewed as a way of bringing together different disciplines in a meaningful and practical manner so that students perceive knowledge and skills as whole rather than discrete pieces. This approach is consistent with our natural way of thinking, that is holistic most of the time. [1].

It is possible to relate differing curricula through integrated teaching approach to each other. Curricula can be integrated within a single discipline, in an interdisciplinary manner or in a student-oriented manner by using different models in line with the objectives set.

Integrated Teaching Approach: Several definitions of integrated curriculum are available. Whereas the definitions were formerly in relation to the structure of planning and of curriculum, they were then based on more flexible and student-centered approaches. Many educators' views have been influential in the formation and development of the concept of integrated curriculum. Kysilka (1998), based on different theoreticians' views, points out the properties of integrated curriculum as:

- The most important activities are those which are directly related to students' interests and needs.
- Knowledge in real life is enforced in an integrative way rather than in pieces.
- Field of subject is an instrument, not a target. Individuals need to know how they learn and think; not to be protected from reality.
- Teachers and students should work in cooperation in the teaching-learning process in order for the learning to be successful.
- Knowledge is not static and it improves and changes rapidly. [2].

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According to Jacobs (1989), an integrated curriculum is a mentality of curriculum benefiting from the methods and knowledge of more than one discipline so as to study a theme, a concept or a problem [3]. In relevant literature such concepts as interdisciplinary, thematic, or synergetic are also used instead of integrated curriculum (Lake, 1994; Quoted by, Ayvaz Tuncel, 2009). [4]. The benefits of the interdisciplinary approach to students are listed by Erickson (1995) as in the following:

- It ensures that students focus on significant and current issues, concepts and problems and thus they become aware of the happenings around them and in the world and they make advanced generalizations by going into details in thinking and in ideas.
- The curriculum keeps students bus with activities and directs them into research, investigation and learning the use of knowledge in various styles and models and thus it assures that students employ their creativity (Quoted by; Duman&Aybek, 2003) [5].

In consequence of teaching based on disciplines problems such as losing meaning of the learnt knowledge, being isolated from daily life, abstractness of knowledge and skills and difficulty to enforce them arise [1]. While a Science teacher working in an elementary education school is presenting a science concept, he/she should present the parts of the concept related with Physics, Chemistry and Biology in integration.

Gürdal, Sahin&Bayram (1999) explains the reasons for making integration in Science teaching as:

- Science includes the concepts of Physics, Chemistry and Biology. Integration is needed so as to establish relations between those concepts. This is essential for meaningful learning.
- Integrated teaching facilitates accounting for events in Science studies in integration.
- Integrated teaching affects learning in a positive way. (Quoted by Aydin&Balim, 2005). [6].

Elementary Education Science and Technology Curriculum in Turkey: In the context of curriculum development activities in Turkey, activities for elementary education Science and Technology curriculum were started in the 2004-2005 academic year; a draft was prepared, pilot application was done and it was accepted to enforce beginning with the 2005-2006 academic year. The curriculum is based on the principles of constructivism, thematic, student-centeredness and activeness.

Skills such as critical thinking, creative thinking, problem solving, using information technologies, entrepreneurship, caring personal and social values are emphasised in the renewed science and technology curriculum. Students are assigned the role of individuals who construct problems, solve problems, perform activities of uncovering and evaluating for the needed knowledge- just like a scientist and play an active part in forming their own cognitive structure through activities rather than the role of individuals who listen, do exercises and answer the questions in the novel curriculum. Thus, students' active role and role of constructing knowledge are heavily stressed in the new curriculum. A student is an individual who knows how to reach knowledge, restructures knowledge in mind and consequently is able to generate the new knowledge.

One of the most remarkable changes reflected in the curricula is defining the "intermediary disciplines" and relating them to learning fields. The intermediary disciplines are defined in elementary curricula as other disciplines which are taken into consideration in the curriculum preparation process and which overlap with the main disciplines clearly and in a comprehensive way. The approach of intermediary disciplines stems from "the fact that knowledge cannot be restricted to a certain field" and from "the need to integrate learning fields". The intermediary disciplines inserted in the curriculum emerge in the consequence of thematic structuring of contents related to certain fields. The intermediary disciplines are the shared objectives of the whole curriculum and are composed of various disciplines students will attend to and will need throughout their lives to adjust to various situations. Intermediary disciplines are the contents which enrich the curriculum, improve the reality and relating power of the curriculum. The fields- which are specified as Disaster Training, Entrepreneurship, Human Rights and Citizenship, Developing Career Consciousness, Special Education, Guidance and Counseling, Health Culture, Sports Culture and Olympic Education – are included in the backbone of the curricula in an interdisciplinary approach.

The curriculum for Science and Technology course was developed within the framework of a holistic curriculum approach. The vision of the curriculum is to raise all the students, whatever their individual differences are, as science and technology literate. Science topics are

handled by considering the technology dimension in the curriculum. In renewing the curriculum, the constructivist approach requiring students' active participation in the learning process was considered essential. Knowledge related to separate disciplines were chunked and a thematic approach was adopted. The content was organised on the basis of "cyclical approach"; therefore, the basic concepts in four fields of learning were dealt with in each classroom, yet as moving to the upper grades, the depth in knowledge, mentality and skills which were pointed out in objectives increased. Four learning fields are available in Science and Technology curriculum: "Living Things and Life, Matter and Change, Physical Events, the World and the Universe" [7].

Purpose of the Research: This study aims at evaluating the curricula for the 4th and 5th grades Science and Technology courses in terms of integrated teaching approach based on curriculum design and teachers' views. Science and Technology course is available in the 4th to 8th grades of elementary education in Turkey. However, the scope of this research is restricted to the first stage of elementary education- which contains Science and Technology curricula for the 4th and 5th grades.

MATERIALS AND METHOD

Document examination and interview, two of the qualitative research methods, were used in this research. The 4th and 5th grades curricula for the Science and Technology course as well as the interview forms were utilised as sources of data. Skills in the curricula, learning fields, objectives and activities were considered as units of analysis. Focussed group interviews were made with 20 teachers who were chosen through easily accessible case sampling from among the elementary education schools in the central provinces of Ankara. 8 teachers forming the research sample were elementary school teachers whereas 12 of them were branch teachers and they had a minimum of 5-year experience. The data obtained from semi-structured interview forms were analysed through descriptive analysis. And the data obtained from document analysis were made numerical, tabulated and interpreted. [8].

RESULTS AND DISCUSSION

Integration of 4th and 5th Grades Science and Technology Course Curriculum with Other Courses' Curricula: On examining Table 1 and evaluating the objectives in Science and Technology course for the 4th and 5th grades together, it is found that the most associations were established with Turkish course (12%); which is followed by the courses of Social Sciences, (7%), Mathematics and Art (5%), Music (3%) and Craft Education(2%). Generally, the number of associations may be said to be insufficient. When compared in terms of grade levels, it is found that in parallel to the rise in grade levels the number of associations rises except for Social Sciences and Craft Education. The most associations for the 4th grade were made with Social Sciences whereas the most associations for the 5th grade were made with Turkish.

Which objectives of Science and Technology course are associated with objectives in Music, Craft Education and Physical Education is not stated in the curriculum; but a general statement is made. Objectives concerning those courses are shown in the table as one objective. Only one association was made with the course of Physical Education for the fourth grade.

Teachers whose views concerning the aims of associating were asked for considered associations with other courses positive in general and stated that it was useful in making learning permanent, in relating the course to real life and in removing the disconnections between courses.

Table 1: Integration of 4th and 5th Grades Science and Technology Course Curriculum with Other Courses' Curricula

Grades	Number of Objectives	Turkish	%	Mathematics	%	Social Sciences	%
4	178	7	4	3	2	11	6
5	196	16	8	6	3	1	1
4 and 5	374	23	12	9	5	12	7
	Number of Objectives	Music	%	Art	%	Craft Education	%
4	178	1	1	1	1	1	1
5	196	3	2	7	4	2	1
4 and 5	374	4	3	8	5	3	2

"I think that the fact that a student finds a place for knowledge of a discipline in other disciplines and makes his knowledge functional increases the permanence of his knowledge". (T 2)

"Associating the course of Science and Technology with other courses enables students to see the connections of the course with daily life." (T 11)

"Associating was done in order not to cause disconnections between courses."(T 18).

Teachers usually stated that they attached importance to the associations in the curriculum and that they benefited from other courses in planning their class as far as possible.

"I consider associations important and I share them with other branch teachers, I learn about associations possible to be made and I use them". (T 2)

"I consider some of the associations appropriate. Such as associating with occupations, telling about scientists' life stories and their discoveries." (T 7)

"Drawing the picture of a zoo in a course of Art related with the classification of animals could facilitate learning." (T 3)

Teachers stated that associations helped understanding the subject matter and students' participation; therefore, they tried to apply associations but that time restrictions hindered their efforts and that they could not perform evaluations every time. Some of the teachers said that they found associations insufficient and they also criticised about the fact that no details had been given as to how to make associations.

"I believe that associating with courses is more effective compared to intermediary disciplines both in application and evaluation." (T 2)

"No detailed information or a source concerning the application is available in the curriculum. Moreover, applications are told in very simple sentences, no details are given. I don't have any evaluations regarding the associations"(T 9)

"I apply them when it is appropriate time. I don't make other evaluations" (T 17)

"In my opinion, there is inadequacy in associations; associations with differing courses may also be made." (T 7)

Research conducted by Demirel and Diker Coskun (2008) found that associations made in Life Studies course were restricted to Turkish and Mathematics. In interviews with teachers, the fact that it guided teachers, that meaningful and permanent learning occurred in students and that colleague solidarity was ensured were stated as positive properties of the curriculum for Life Studies in terms of associating the course with other courses. As to the associations with other courses, teachers criticised that this dimension was not detailed enough in the curriculum, some of the associations were not appropriate to students' level and the time of presenting some of the topics was not appropriate. [9]

Integration of 4th and 5th Grades Science and Technology Course Curriculum with Intermediary Disciplines: In the Science and Technology course curriculum 178 objectives for the 4th grade and 196 objectives for the 5th grade are available. As is clear from Table 2, in the 4th grade 3% of those objectives were associated with Sports Culture and Olympic Training, 7% with Health Culture, 4% with Guidance and Counselling 4% with Developing Career Consciousness whereas in the 5th grade, 3% of the objectives were associated with Sports Culture and Olympic Training, 9% with Health Culture, 1% with Guidance and Counselling and 3% with Developing Career Consciousness.

As Table 2 shows, in the 4th grade, 1% of objectives were associated with Entrepreneurship, 1% with Protection from Disasters and Safe Living, 1% with Special Education and 3% with Human Rights and Citizenship. As to the 5th grade level, 3% was associated with Human Rights and Citizenship and no associations were made with intermediary disciplines of Entrepreneurship, Protection from Disasters and Safe Living and Special Education.

As is clear from Table 2, the most associations were made with Health Culture; the least associations were made with Protection from Disasters and Safe Living. The approach of intermediary disciplines stems from the fact that knowledge may not be restricted to a certain field and from the necessity to integrate learning fields (Quoted by Gözütok&Alkin, 2008). [10]. However, on examining the table closely, no sufficient levels of associations are found in terms of quantity and content. Besides, research by Güven, Gökbulut&Yel (2006) also emphasises that associations are not fully made with intermediary disciplines in the 4th and 5th grades Social Sciences courses. [11].

Table 2: Integration of 4th and 5th Grades Science and Technology Course Curriculum with Intermediary Disciplines

Grades	Sports Culture and Olimpic Training	%	Health Culture	%	Guidance and Counseling	%	Developing Career Consciousness	%
4	5	3	13	7	7	4	7	4
5	5	3	17	9	2	1	5	3
4 and 5	10	3	30	8	9	2	12	3

Table 2: Integration of 4th and 5th Grades Science and Technology Course Curriculum with Intermediary Disciplines (Continued)

Grades	Entrepreneurship	%	Protection from Disasters and Safe Living	%	Special Education	%	Human Rights and Citizenship	%
4	2	1	1	1	1	1	6	3
5	-	-	-	-	-	-	6	3
4 and 5	2	0,5	1	0,3	1	0,3	12	3

Generally, teachers hold the view that associations with the intermediary disciplines are made in line with the objectives. They are of the opinions that the function of intermediary disciplines is to make objectives permanent and to help students associate the learnt material with daily life.

Consciousness about such issues as hand and body cleanliness and food hygiene was created in the association with intermediary discipline of 'Health Culture' which was related with microscopic organisms in the unit entitled "Let's Travel in and Get to Know the World of Living Things". Students' interest and participation was good; and also they found it very interesting when they learnt that useful micro organisms had contributions to human health. (T 2).

"It serves to the purpose. Students relate the presented material to the intermediary disciplines and become more interested in the issue; thus, they become better researchers." (T 5)

The teachers pointed out that they mostly employed intermediary disciplines in planning their lessons. And they said that when time restriction was a problem, they assigned such activities as homework.

"Science and Technology is the most intensive course in grade 5. While covering the topics in the curriculum, we make use of the intermediary disciplines and if we have any time-related problems, we give it as homework". (T 5)

"For instance, we often made use of associating erosion with natural disasters". (T 1)

Teachers stated that they encountered problems in intermediary disciplines of Developing Career Consciousness, Human Rights and Citizenship and Guidance and Counseling in associating with the course of Science and Technology.

"Because it is a distant objective for the 5th graders, occasionally problems were faced in career consciousness. The others were easy and enjoyable. "Health Culture", in particular, was the most easily applied intermediary discipline." (T 2)

It is easy to make associations with "Human Rights and Citizenship" but it is difficult with "Sports Culture and Olympic Training". (T 17)

Teachers hold the view that lack of time and crowded classes make application and especially evaluation of intermediary disciplines difficult.

"Because length of classes is not sufficient, associations cannot be made for every topic." (T 11)

"I usually apply associations with intermediary disciplines; but I cannot analyse them." (T 9)

"I do not make evaluations based on gains in intermediary disciplines. I can only mention the intermediary disciplines in brief and then I pass them." (T 12)

Teachers are of the opinion that there is no awareness rising in the application and evaluation of intermediary disciplines.

"I don't think there is enough study or research in the application and evaluation dimension of intermediary disciplines. Teachers should be offered in-service training about this, relevant research findings should be shared and their significance should be emphasised." (T 2)

"Work concerning the intermediary disciplines recommended by the Ministry of Education is not sufficient. I would like to find more examples for Science and Technology, which I believe is one of the fundamental courses. I see that most teachers don't have efforts to set up relations with intermediary disciplines. I believe teachers should also be made conscious." (T 16)

Research conducted by Gözütok&Alkin (2008) aimed to determine views concerning the functions, philosophy and application of intermediary disciplines approach through interviews with 49 teachers. It was found that more than half of the teachers were not informed of the concept of intermediary disciplines or they were misinformed of the meaning and function of the approach. It was also found that most of the teachers confused the concept of intermediary disciplines with other features of the curriculum (such as associating between courses), they could not evaluate intermediary discipline objectives, they had difficulty in associating with course objectives, they found the curriculum and the books inadequate in terms of intermediary disciplines and that they were not informed of intermediary disciplines by any sources. [10].

CONCLUSION

This research makes an attempt at doing a critical analysis of the renewed curricula for the 4th and 5th grades Science and Technology course in Turkey from the perspective of integrated curriculum approach. The fact that space is allocated to associations within courses and with other courses as well as with intermediary disciplines in the renewed curriculum for the 4th and 5th grades Science and Technology course indicates that an integrated curriculum approach is adopted, which may be considered a positive feature. However, the research findings reveal that there are problems in associations with other disciplines and with intermediary disciplines in the curricula for the 4th and 5th grades Science and Technology courses.

The intermediary discipline concepts, objectives and applications which were determined by the new elementary education curricula were included in all the course curricula so as to cover in the vertical and horizontal axis of each course. Thus, education was associated with life and a property which enabled students to develop in a multi-directional way was given to the curriculum.

It was found that associations with other disciplines and intermediary disciplines in the curriculum for the 4th and the 5th grades Science and Technology courses were weak. However, unlike other courses (Life Studies, Turkish, Mathematics and Social Sciences), it was positive that Science and Technology course was associated with the courses of Craft Education, Music and Physical Education, at least slightly.

The most associations were made with Social Sciences in the 4th grade and with Turkish in the 5th grade. According to the findings obtained through interviews with teachers, teachers consider associations with other courses in the course of Science and Technology sufficient, they attach importance to this and they reflect this into their planning as far as possible and thus they try to apply it. Yet, during application, teachers encounter problems in associating the objectives in Science and Technology with objectives in other courses. That concrete examples or sufficient explanations were not available in the curriculum and that branch teachers did teach the courses of Physical Education, Music, Visual Arts and Technology and Design were stated as the causes of the problem. And associating with intermediary disciplines was considered as a more problematic issue. Research studies conducted by Demirel&Diker Coskun (2008) and Gözütok&Alkin (2008) also put forward similar problems about intermediary discipline approach [9, 10]. Problems were faced especially in associating with the intermediary disciplines of Citizenship and Human Rights, Guidance and Counseling and Developing Career Consciousness. On the other hand, Sports Culture and Olympic Training were seen as easy intermediary disciplines to associate with Science and Technology course.

Integrated curriculum provides students with opportunities to see the whole in the overloaded curricula and thus enable knowledge transfer between curricula [12]. The influence of integrated curricula on cognitive and affective learning outcomes was revealed through several pieces of research. [10, 13, 14, 15, 16, 17] Yet, due attention should be given to perform transitions between objectives and to make interdisciplinary connections in a comprehensive and systematically way in the process of integrating the curricula. It is observed in this research that Science and Technology curriculum has inadequacies in terms of mentioned properties.

In consequence, it may be said that regulations that were made in the curricula for the integration of Science and Technology course with other courses

and with intermediary disciplines were positive attempts; and that considering the problems which implementers of the curricula- teachers- encounter and some of which have been demonstrated by this research, some regulations are required. In this context, it is thought that extra materials such as manuals, resources and brochures to be offered to teachers through in-service training for associating with other disciplines would be beneficial.

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