Education and Science

Vol 39 (2014) No 174 388-401

Constraints of Curriculum Implementation as Perceived by Turkish Biology Teacher *

Ebru Öztürk Akar [1]

Abstract

The purpose of this cross-sectional descriptive study is to identify the constraints perceived by teachers in the implementation process of secondary school biology curriculum in Turkey. Sample of the study consists of 128 biology teachers working in 119 public schools in 12 provinces of Turkey. Data were collected through a survey questionnaire. Descriptive statistics and qualitative data analysis techniques were used to examine teachers' beliefs and to make additional inferences about the constraints they experience. The results highlighted lack of alignments between curriculum change, teacher development, assessment practices, availability of the resources and the intended curriculum. The study discusses the implications of the results concerning policy, practice and further research.

Keywords

Curriculum reform
Curriculum implementation
Teacher response

Article Info

Received: 03.18.2014
Accepted: 06.05.2014
Online Published: 08.06.2014

DOI: 10.15390/EB.2014.3092

Introduction

Over the last decade, significant efforts have been made to bring change to science classrooms through curriculum reform. Researchers all over the world study curriculum innovations in science and investigate the ways in which teachers transform these innovations when putting them into practice. Similar factors are reported that increase the complexity of curriculum delivery such as teacher beliefs, knowledge, attitudes, competencies, space and facilities, time constraints, the role of school principal as an instructional leader, students' ability level and interests, and the priority placed on science as a curriculum area (Anderson, 2002; Barab and Luehman, 2003; Boote, 2006; Davis, 2003; Hume and Cole, 2010; Lewthwaite, 2005; Roehrig, Kruse and Kern, 2007; Rogan and Grayson, 2003).

Turkey has experienced periodic curriculum failures due to some of the above mentioned factors such as poor teacher preparation, ineffective teaching methods, a lack of teaching aids, and overcrowded classrooms (Ayaş, Çepni and Akdeniz, 1993). Yet, Turkish students' poor performance in international studies, science curricula of leading countries in these studies and effects of globalization were used as reference for the development of the current elementary and secondary school science curricula in the last decade (MNE 2007, 2013).

This study is an attempt to identify the constraints perceived by teachers in the implementation of secondary school biology curriculum which is developed in 2007 and will be in use until 2017 (MNO, 2007). Considering the fact that a new curriculum, named 2013 curriculum in this study, has already replaced the 2007 curriculum in 9th grades, it is critical to identify the perceived

* This study was presented in ISNITE'2013 Symposium.

[1] Abant İzzet Baysal University, Turkey, akar_e@ibu.edu.tr

constraints during implementation process to conclude if the development of a new curriculum helps to overcome these constraints. To this aim the following research question has been formulated: *What kinds of constraints do teachers perceive in the implementation of the secondary school biology curriculum?*

Although, the 2013 curriculum is presented to have new characteristics, the process of its development and the way it was presented to teachers is open to same critics with the 2007 curriculum. For instance, the process of curriculum development was rushed and had not been discussed in a wider context at sufficient length. Outcomes of the piloting process, which include teacher and student feedback, and the modifications that were made based on the feedback, were never reported and discussed in an open forum (Akşit, 2007). Teachers were solely provided with the curriculum and expected to implement it as they are obliged to implement the curriculum as it is intended. Moreover, a comparison with the last curricula indicated that they look quite similar in terms of their content and the main approaches (see table 1). Ongoing discussions associated with the curricular practices still focus on the barriers that were also involved in the older curricula such as capabilities of teachers, lack of school facilities and their maintenance, and presence of centralized examinations for secondary and higher education (Öztürk-Akar and Yıldırım, 2011; Şahin, 2010). Implying a technocratic modernization of the curriculum, these discussions highlight the importance of analyzing educational context, its needs, and dynamics. It would then be possible to overcome the constraints, improve the educational practices and facilitate intended changes.

Table 1. Characteristics of 1998, 2007 and 2013 Secondary School Biology Curricula

	1998 curriculum	2007 curriculum	2013 Curriculum
Duration	1998-2007	2007-2013	2013-present
Main approach	Constructivism	Constructivism	Not labeled
Knowledge, skills and attitudes	Being able to relate lessons to daily life and health issues	Science – technology – society – environment Research and science process skills Communicative skills, attitudes and values	Understanding and utilization of scientific knowledge Science process skills Science-Technology-Society Values and attitudes towards science Understanding the nature of scientific knowledge 21st Century skills
Teacher roles	Facilitator/guide	Facilitator	Facilitator/guide
Student roles	Active learner who can meaningfully use and evaluate scientific knowledge	Scientifically literate individual	Active learner who can meaningfully use, construct and evaluate knowledge
Learning env.	Student-centred	Student-centred	Student-centred
Content organization	Spiral structure of content and knowledge	Spiral structure of content and knowledge	Spiral structure of content and knowledge: Basic and advanced level
Main headings of curriculum content	"Structure and function of biological molecules" "Structure and function of living organisms" "Genetics, ecology and biotechnology"	"Cell, organism and metabolism" "Biological diversity, genetics and evolution" "Ecology"	Biology: Life Science World of Living Things Environmental Problems Reproduction Principles of Genetics Earth Energy Transformation Human Physiology Behavior
Evaluation	Process based	Process based	Process based

(MNE, 1998, 2007; 2008a; 2008b; 2009, 2013)

Constraints Facing Curriculum Reform Efforts in the Last Decade

Interest in the implementation process after a curricular change is still a worldwide phenomenon. Existing research shows that change process has a multidimensional nature (Tytler, 2007). Hence, calls made for change in the reform documents are difficult to put into practice (Anderson and Helms, 2001). Many of the difficulties schools face are due to problematic assumptions about schooling that seldom get examined. Therefore, research which is conducted in the real world and which attends to constraints acting upon curriculum implementation is needed (Eisner, 2000; Mansour, 2010).

There is a substantial amount of research in the international literature that report factors hindering curriculum implementation. Situational factors such as school and classroom cultures, large class sizes, inadequate school facilities, resource limitations, lack of time and the nature of the curriculum are listed to impede the instructional practices (Datnow, 2002; Dello-Iocovo, 2008; Fang, 1996; Munby, Cunningham, and Lock 2000; Stoffels, 2005). The powerful influence of the social context that resulted from the institutionalized curriculum and the expectations of students, parents, fellow teachers and superiors, are also identified to cause mismatches between curricular intentions and practices (Ernest, 1988). High stakes testing is another reason of why teachers retain traditional teaching methods contrary to reform intentions (Jones, Harlow and Cowie (2004; Zhang, Krajcik,

Wang, Hu, Wu, Qiang, et al., 2003). Teacher' misunderstandings or lack of knowledge, differences of opinions about subject matter and the attraction of their old habits may also impede the transformation of curriculum innovations into practice (Pinto, 2005; Mansour, 2010). Teachers may be unprepared for the tremendous amount of pedagogical shifts that the new curriculum requires of them (Cross, Mungadi and Rouhani, 2002).

An overview of studies investigating the situation in Turkish biology classes after curricular changes pointed to the influence of similar constraints acting upon curriculum implementation. Moreover, such constraints i.e. a lack of qualified teachers, a loaded content, inadequate class hours, crowded classrooms, physical facilities of the schools, insufficient laboratory resources, negative effect of university entrance exam and orientation towards rote learning among students, have become permanent problems of biology education in Turkey (Atav, Erdem, Yılmaz and Gücüm, 2004; Ensari and Kete, 2010; Öztürk, 1999; 2003; Taşçı, Yaman and Soran, 2010; Yılmaz, 1998). Majority of the biology teachers are reported to be in the need of in-service training whereas only a few of them can participate in these courses (Atav, 2005; Köseoğlu and Soran, 2004). Teachers expect curriculum be revised, class hours be increased, textbooks and schools' physical facilities be improved (Altunoğlu and Atav, 2005; Ensari and Kete, 2010; Gerçek and Soran, 2005). Yet, the development of good-quality biology curricula was seen as the sole solution to the problems experienced. However, the compounding problems of curriculum delivery call for bringing out teachers' perspectives and experiences of constraints affecting the enactment of the curriculum.

Method

This is a cross-sectional descriptive study. Constraints in curriculum implementation were explored through teachers' curriculum related perceptions and experiences. A previously designed survey questionnaire, Biology Curriculum Implementation Questionnaire - BCIQ (Öztürk, 2003; Öztürk Akar, 2013), was utilized to gather data on teachers' beliefs about the constraints they experience in implementing the curriculum.

Sample

The participants of the study were 128 biology teachers working in 119 randomly selected public secondary schools in 12 cities. A two step sampling strategy i.e. stratified and cluster random sampling was used to reach teachers. Statistical Regional Unit Classification by Turkish Statistical Institute (TSI, 2011) i.e. a classification based on the provinces' population, geography, regional development plans, basic statistical indicators, and socio-economic development, was used as the main criteria to randomly select 12 cities and 119 public secondary schools. One province and at least one school from each Statistical Region were represented in the sample. The return rate for the questionnaires was 46% (278 teachers were working in the selected schools). Considering sample size (n=128), this return rate allowed running intended statistical analysis.

The majority of the participant teachers was female (65.85 %), and had 16 to 20 years of teaching experience (30.70 %). 46.15 % of the teachers participated in in-service training courses organized by the Ministry of Education for three or more times, whereas teachers who did not attend such courses comprised 23.08 % of the sample (See table 2 for teacher characteristics).

Table 2. Descriptions of the Sample

Variables		N	%
Gender	Female	81	65.85
	Male	42	34.15
Experience	1-5 years	17	14.91
	6-10 years	12	10.53
	11-15 years	28	24.56
	16-20 years	35	30.70
	21 years and more	22	19.30
In-service Training	None	27	23.08
	Once	20	17.09
	Twice	16	13.68
	More than twice	54	46.15

Note: N's vary somewhat due to missing data

Instrument

BCIQ is developed and revised by Öztürk (2003; 2012) to identify the factors influencing secondary school biology curriculum implementation process, and to examine the relationships between these factors and the process of curriculum implementation. Öztürk (2003; 2012) draws together recurring themes from curriculum and biology education literature, and locate these themes within a framework of "*Beliefs*" "*Constraints*" and "*Solutions*". "*Beliefs*" construct is used to determine teachers' perceptions of curriculum and the curriculum implementation process. "*Constraints*" construct explores teachers' perceptions of teaching context in general. "*Solutions*" refer to the teachers' practical suggestions to overcome the constraints they experience in implementing the curriculum.

BCIQ consists of 13 factors, 5 Beliefs about Curriculum factors, 5 Constraints of Implementation factors, and 3 Solutions and Suggestions factors. Within the scope of this study 5 Constraints of Implementation factors were utilized. These factors are context of teaching (loaded curriculum content-lack of time, well-prepared textbooks and university entrance exam) (4 items), student related problems (7 items), lack of resources (7 items), content organisation (3 items) and teachers' own lack of capabilities (5 items) with possible responses from 1 (never) to 5 (always) (see table 3). The question of"How often do you experience the below constraints in teaching biology?" is asked and teachers were provided with a list of 27 alternatives that were primarily negatively worded. Teachers' general view of the constraints of curriculum implementation was also asked in an open-ended question.

Data Collection

Data were gathered during the spring semester of 2010-2011 academic year. An envelope including the questionnaire, an application guideline for principals, a consent form for teachers and an empty envelope for the completed questionnaires was sent to schools. In a period of two-months, the questionnaires were sent back to the researcher.

Data Analysis

Confirmatory Factor Analysis (CFA) was conducted by using LISREL 8.80 (Jöreskog and Sörbom, 2007) to check if the 5 factors-structure would be confirmed in the present sample. In order to assess the data fit, X^2/df ratio (≤5), Root Mean Square Error of Approximation (RMSEA) (≤.08), and Comparative Fit Index (CFI) (≥.90) were used (Jöreskog and Sörborn, 1993; Kline, 2005; Tabachnick and Fidell, 2007).

Descriptive statistics (the frequency, percentage, total mean score and standard deviation of each item) were used to examine teachers' beliefs about the constraints they experience in implementing the curriculum. Mean scores on each factor were used to come to conclusions about participants' beliefs about the constraints they experience in implementing the curriculum.

Qualitative data were included to make additional inferences about teachers' beliefs and experiences of curriculum implementation. Teachers' responses to the open-ended question were subjected to content analysis. A team of two field experts coded raw data, grouped similarities and differences in responses, drew pattern of responses, and made inferences and generalizations (Patton, 1990; Miles and Huberman, 1994). Inter-coder reliability was %85

Results

CFA of BCIQ

Results of the CFA for the 5 Constraints of Implementation factors demonstrated acceptable fit to the data $X^2/df=1.40$; RMSEA=0.056; CFI=0.97. Internal reliability of the subscales ranged from 0.66 to 0.90. As the sample size is greater than 50 (n>50) and number of items is close to 30 (k=28), reliability coefficients between 0.66 and 0.90 are accepted to be highly reliable. Internal reliability of the factors, items and their parameter estimations are presented in Table 3. As seen in Table 3, standardized parameter estimations (S.E.) ranged from 0.56 to 1.20, which showed that the items were significantly predicted by their factors. Table 4 shows the results of the correlational analysis of the constraints experienced by teachers in implementing the curriculum. As seen in Table 4, these correlations were statistically significant and greater than 0.35 suggesting that teachers who experienced a constraint in one area tended to state that they also experienced constraints in other areas.

Table 3. Summary of the Confirmatory Factor Analysis for the Constraints of Implementation Factors

Item	P.E.	S.E.	T values
Context of teaching (α=.76, Item mean=3.48)			
Lack of time (M=3.66, SD=1.40)	0.96	1.01	8.67
University Entrance Examination (M=3.70, SD=1.23)	0.84	0.84	8.03
Loaded curriculum content (M=3.42, SD=1.24)	0.89	0.81	7.67
Lack of well-prepared textbooks (M=3.16, SD=1.29)	1.04	0.80	7.16
Student related problems (α=.87, Item mean=3.25)			
Students' tendency to rote learning (M=4.02, SD=0.98)	0.48	0.70	8.86
Low ability level of students (M=3.41, SD=1.12)	0.44	0.90	10.56
Having students at different ability levels (M=3.41, SD=1.16)	0.75	0.78	8.17
Students do not actively participate in the lessons (M=3.31, SD=0.37)	0.56	0.62	7.65
Students' lack of knowledge and misconceptions (M=3.11, SD=0.99)	0.60	0.63	7.56
Students' negative attitude towards biology lessons (M=3.06, SD=0.91)	0.44	0.62	8.45
Students' lack of interest in biology (M=2.89, SD=0.93)	0.50	0.61	7.90
Biology is seen as an important lesson by the students (M=2.83, SD=1.12)	0.78	0.69	7.35
Lack of resources (α=.90, Item mean=3.14)			
Lack of laboratory equipment (M=3.44, SD=1.34)	0.37	1.20	12.69
Being unable to carry out the curricular activities with available facilities (M=3.30, SD=1.07)	0.66	0.71	8.13
Lack of physical facilities in the school (M=3.09, SD=1.44)	0.81	1.09	10.06
Being unable to formalize abstract knowledge (M=3.14, SD=1.00)	0.69	0.56	6.61
Limited reach to resources (M=3.07, SD=1.27)	0.50	1.06	11.32
Being unable to use technology (M=2.97, SD=1.33)	0.66	1.06	10.48
Being unable to show films, slides, tables, etc. (M=2.95, SD=1.23)	0.67	0.93	9.72
Content Organization (α=.66, Item mean=2.86)			
Changes in the curriculum content (M=2.92, SD=1.23)	0.81	0.85	7.86
Curricular activities are difficult (M=2.81, SD=1.09)	0.88	0.58	5.68
Students have learning difficulties due to organization of curriculum content (M=2.84, SD=1.18)	0.74	0.81	7.74
Teacher incapability (α=.80, Item mean=2.71)			
Lessons do not increase interest in scientific thinking, learning, researching (M=3.15, SD=1.05)	0.58	0.73	8.36
Students cannot be activated in lessons (M=2.92, SD=0.99)	0.49	0.70	8.61
Curriculum content cannot be related with daily life issues (M=2.59, SD=0.96)	0.55	0.61	7.56
Lessons cannot answer students' questions (M=2.53, SD=0.93)	0.38	0.71	9.39
Addition of new subject matter to curriculum content (M=2.34, SD=1.07)	0.79	0.60	6.47

Table 4. Results of the Correlational Analysis

	1	2	3	4	5
Context of teaching					
Student related problems	.58				
Lack of resources	.62	.62			
Content organization	.62	.55	.45		
Teacher incapability	.58	.66	.58	.58	

Note: All correlations are significant at .p<.05

Descriptive findings about teachers' beliefs about constraints of curriculum implementation are presented below.

Teacher Perceptions of Constraints Operating on Curriculum Implementation

As seen in Table 3, teachers' major obstacles that they were often constrained with were related with the context of teaching. Although they were expected to teach loaded curriculum content, teachers were not provided with enough class hours and well-prepared textbooks. The presence of the university entrance examination was another important constraint on curriculum implementation. Students' tendency to rote learning, their low ability levels, lack of knowledge and misconceptions also negatively influenced the way teachers carry out curricular practices. According to their teachers, students were not interested in biology and had a negative attitude towards biology lessons. They did not see biology as an important lesson and did not actively participate in classes.

Lack of resources was another constraint, sometimes disturbing the flow of curriculum implementation (See table 3). For teachers, schools lacked physical facilities and laboratory equipment. The available facilities did not support curricular practices. Teachers were constrained by the fact that they had limited access to resources, and were consequently unable to use technology and instructional materials.

Organization of curriculum content also put constraints on implementation practices. Frequent changes and difficult activities ended up with students' learning difficulties. Based on teacher responses to the related items (see table 3), it is also inferred that teachers' own lack of capabilities was yet another important constraint of curriculum implementation such as being unable to increase student interest in scientific thinking, learning and doing research, being unable to motivate students in lessons, to relate curriculum content with daily life issues, to answer student questions and to teach new subject matter.

Teacher responses to the open ended question helped to elaborate the most frequently rated constraints they experienced; namely loaded curriculum content and its organization (n=70), lack of time (n=21) and university entrance examination (n=18). For instance, teachers were critical about the allocated time (n=21) because class hours were not enough for teaching the subject matter and carrying out experiments, activities and projects at the same time (n=16). There was a need for separate practice hours for biology classes. Teachers also criticized the loaded curriculum content stating that it was too detailed, disorganized and complicated for secondary school students (n=32). Continuity of the subject matter was broken, which led to students' difficulty in learning biology (n=11). Curriculum content was also criticized for its inadequacy and inconsistency with the coverage of university entrance examination (n=27). While some of the teachers mentioned that the curriculum should be organized considering the needs of the students preparing for the exam (n=12), some others mentioned that the university entrance exam should be abolished because it does not concur with the philosophy of the curriculum (n=6).

Discussion, Conclusions and Suggestions

Discussion

This study examined constraints of implementing 2007 secondary school biology curriculum from the teachers' perspectives. Considering the duration of its implementation until 2017, findings of this study are significant that they provide a ground to discuss if the 2013 curriculum contributes to the highlighted needs of the biology education in Turkish secondary schools. As the highlighted needs, this study makes a call for educational policies and strategies to meet the challenges faced by teachers, new forms of teaching and teacher education, new approaches to student assessment and new instructional materials in the total presence of the identified constraints (Black and Atkin, 1999). The findings are discussed below:

Although not clearly labeled in the 2013 curriculum, the intended secondary school biology curriculum of the Turkish educational system within the last 16 years is based on constructivist philosophies. Similar to its predecessors, the current secondary school biology curriculum includes major characteristics of international science innovation endeavours such as inclusion of more science process skills, connecting students' work to the real world and giving more responsibility to students for their own learning (van den Akker, 1998). Teaching and learning is thus claimed to be student-centred. Yet, teacher responses showed that the allocated class hours for the loaded, too detailed and disorganized curriculum content constrained teachers to conduct intended curricular practices. Yet, it is known that with the 2013 curriculum, allocated hours for biology classes have increased from 396 hours to 432 hours, and the number of objectives has decreased from 167 to 109. Thus, teachers would have more time to do activities and experiments (MNE, 2013).

Findings of this study also pointed to the students' disinterest in the subject and lack of their participation in lessons as other constraints of 2007 secondary school biology curriculum implementation. Changes brought out by 2013 curriculum content i.e. a better organization with deletion, addition and/or transfer of subject matter between grade levels, relating subject matter more with daily life, emphasizing interesting ones and suggestions made for teaching learning processes can help to overcome these constraints. However, these changes seem insufficient to overcome another major constraint identified in this study i.e. teachers' own incapability that were impeding their classroom actions. Therefore, it is difficult to say that the 2013 curriculum contributes to the implementation of curriculum intentions without any in-service training provided to teachers. This is because constructivist philosophies and constructivist-inspired pedagogies have not been clearly formulated and communicated by the Ministry of National Education either for 2007 or for 2013 curriculum. Moreover, there were also problems emerging from the proposed "cascade" training and in-service training programs provided to teachers. A limited number of biology teachers can participate in these short term lecture oriented programs. 23.08 % of the participants did not attend such programs yet. Teachers' responses highlighted the fact that realistic guidelines and practical suggestions for biology classes were not provided to teachers in these training programs. The participant teachers complained that the constraints they have to deal with about the context of teaching, their responsibilities to cover a loaded curriculum content and to prepare students for university entrance exam were not taken into consideration in planning and implementing these programs.

Asynchronous changes of curriculum and teacher education programs also caused problems in translation of curriculum intentions into classroom processes. Following the curriculum change, Faculties of Education made the statement that they could not incorporate the changes into their pre-service teacher education courses due to lack of information from the Ministry of National Education (Akşit, 2007). Characteristics of the teacher education programmes at the graduate level i.e. previous 1.5 years non-thesis graduate teacher education programmes and current teaching certification programmes are also criticized for the same reason that curricular changes are not reflected in the courses. Therefore, participants' responses about their familiarity with the curriculum philosophy and readiness to carry out the intended educational practices were not surprising.

Similar to those between curriculum change and teacher development, a lack of alignment between the availability of the resources and intended curriculum was also identified. Teacher responses pointed to lacking resources and schools' physical facilities as other major constraints of implemented curriculum. Despite the comparatively high per student expenditures in secondary education in Turkey (World Bank, 2005), this finding is remarkable for the reason that the availability of resources to support intended changes, as a prerequisite, was not considered during the development of either the 2007 or the 2013 curriculum. Contrary to the call made nearly a decade ago for the improvement of schools' facilities with the same reason (Öztürk, 2003), the situation is still far from being ideal to implement a curriculum built on constructivist views of learning. In general, class sizes are not small, rich materials and educational aids for instruction are usually not available, and facilities are old and generally not well maintained. Constraints of the educational context still stand as one of the major barriers for the enactment of the intended curriculum.

One of the major constraints that participant teachers complained mostly was the university entrance examination, that has a strong impact on curriculum implementation. It slows down the implementation processes and prevents teachers from carrying out the intended constructivist pedagogies. As mentioned by the participant teachers, students' negative attitudes towards biology and rote learning of factual information are becoming common due to the fact that biology questions are known as the most difficult and least correctly answered questions in this exam. Teachers complained that they are directed toward traditional teaching methods because of students and parents' examination related anxieties, loaded content and suggestion for timing of the intended curriculum. Although, 2013 curriculum is expected to bring changes to teaching and learning processes with more class hours, less objectives and better content organization, teachers' doubt about the contribution of curriculum to intended learning outcomes such as students' creativity and problem solving abilities in the presence of such an exam is still significant. Besides, the university entrance exam does not reveal any information about attained curriculum i.e. whether the curriculum objectives have been attained or not. These findings highlighted a major deficiency of the Turkish educational system regarding the curriculum change and assessment practices.

Conclusions

Findings of this study pointed to similar constraints that impact translation of intended curriculum into implemented and attained curriculum in many Anglophone countries, and China, South Africa, Taiwan as well (Boote, 2006; Cross, Mungadi, Rouhani, 2002; Dello-Iacovo, 2008; Hume and Cole, 2010; Jones et al., 2004; Roehrig, Kruse and Kern, 2007; Rogan, 2007; Schneider et al., 2005; Stoffels, 2005; Squire et al., 2003; Zhang et al., 2003). In this regard, this study validated explanations about the reasons of failure of curricular reform efforts worldwide. However, the current practices typified a particularly prevalent tradition of mandated curriculum change in developing countries (Rogan, 2007) i.e. changes in the curriculum content and a very limited investment in teachers are made. Teachers were not involved in the curriculum development process and they were not supported with opportunities for efficient professional development. The resources and physical structure of the educational system were also limiting teachers. It was asserted that teachers can teach in a way about which they did not have enough knowledge and experience. Teachers' needs and complaints were not taken into consideration.

There is a lack of coherence between the intended curriculum changes with other system components in Turkey. Findings also pointed to the fact that intended and implemented curricula were asserted to be identical in the Turkish educational system. Identification of similar constraints that constrain the use and effectiveness of curricula in the last decade also supported the claim that curriculum change was perceived to correct the deficiencies of the Turkish educational system but changing the curriculum content, increasing class hours and/or decreasing the number of objectives (MNE, 2013) is not enough. Remaining existence of other permanent problems of biology education such as a lack of qualified teachers, physical facilities of the schools and negative effect of university entrance exam requires a more comprehensive approach to observe the translation of curriculum intentions into classroom processes.

Recommendations

Any of the above mentioned constraints are neither new nor unique to the Turkish educational context. However, their total presence highlights a lack of a comprehensive and differential view of change in Turkey. Considering the resemblance between the major characteristics of the secondary school biology curricula in the last 16 years, and the continuity of the identified constraints, it is not difficult to make an educated guess that the 2013 curriculum will be replaced with a new one soon. Yet, a systemic change consisting of a careful and deliberate planning of implemented curriculum, effectively organized and continuous professional development of teachers, and improved physical structure of the educational system would help overcoming the constraints and on improving the educational context in Turkey. An advanced analysis of both international and national experiences, formative evaluation of the implemented curriculum, and examination of teachers'

beliefs and knowledge that support or constrain curricular practices would also facilitate the realization of the intended changes. Therefore, all stakeholders i.e. not only policy makers but also science educators, researchers, teacher educators and teachers should be involved in the analysis, design, evaluation and revision of change processes. Systemic investigations should be carried out. All initiatives should be research based and research validated. Considering the parallel changes of the elementary school science, and secondary school physics and chemistry curricula, research on educational context and curriculum studies should be furthered. The budget allocated to research and development in the Ministry of National Education should therefore be increased. There is also a need for an effective evaluative system to assess how the intended 2007 and 2013 curricula are contributing to the achievement of the intended learning outcomes and improve implementation processes. For this reason, formative evaluation has to become a key element of such a system fully integrating a cycle of analysis, design, evaluation and revision (Kuiper, Nieveen and Visscher-Vorman, 2003). This way, the strong impact of the university entrance exam on the implemented curriculum can also be diminished.

Limitations of the Study

This study has some limitations due to the possible influence of social desirability on teacher responses, sample size, generalizability of the results and limitations to analysis. However, heterogeneous structure of the sample considering the teacher characteristics i.e. age, gender and experience, and distribution of the schools where the participant teachers work provide rich data to draw conclusions.

Cross-sectional nature of the study and the way of data collection were other limitations of the study. Utilization of a questionnaire with forced-choice questions might also limited the identification of undefined constraints. Future qualitative and longitudinal quantitative studies in which a large number of biology teachers' experiences are investigated may broaden our understanding regarding the teachers' perspectives of using secondary school biology curriculum in Turkish schools. Through longitudinal studies causative inferences can also be made regarding the identified constraints of using a curriculum.

References

Akşit, N. (2007). Educational reform in Turkey. *International Journal of Educational Research,* 27(2), 129-137.

Altunoğlu, B. D., Atav, E. (2005). Teacher expectations for more efficient biology instruction. *HU Journal of Education*. 28, 19-28.

Anderson, R.D. (2002). Reforming science teaching: what research says about inquiry. *Journal of Science Teacher Education,* 13(1), 1-12.

Anderson, R.D., Helms, J.V. (2001). The ideal of standards and the reality of schools: needed research. *Journal of Research in Science Teaching*. 38(1), 3-16.

Atav, E. (2005). A study about certain demographical characteristics of high school biology teachers' of Turkey. *Eurasian Journal of Educational Research*. 21, 49-61.

Atav, E., Erdem, E., Yılmaz, A., Gücüm, B. (2004). The effect of developing analogies for meaningful learning of the subject of enzymes. *HU Journal of Education*. 27, 21-29.

Ayaş, A., Çepni, S., Akdeniz, A.R. (1993). Development of the Turkish secondary science curriculum. *Science Education, 77*(4), 433-440.

Barab, S. A. and Luehman, A. L. (2003). Building sustainable science curriculum: acknowledging and accommodating local adaptation. *Science Education*, 87(4), 454-467.

Black, P., Atkin, M. (1996). *Changing the subject. Innovations in science, mathematics and technology.* London: Routledge.

Boote, D. N. (2006). Teachers' professional discretion and the curricula. *Teachers and Teaching: Theory and Practice*, 12(4), 461-478.

Carter, L. (2005). Globalisation in science education: rethinking science education reforms. *Journal of Research in Science Teaching*, 42, 561-580.

Cross, M., Mungadi, R. and Rouhani, S. (2002). From policy to practice: curriculum reform in South African education. *Comparative Education*. 38(2), 171-187.

Datnow, A. (2002). Can we transplant educational reform, and does it last? *Journal of Educational Change.* 3, 215-239.

Davis, K.S. (2003). Change is hard: What science teachers are telling us about reform and teacher learning of innovative practices. *Science Education*, 87(1), 3-30.

Dello-Iacovo, B. (2008). Curriculum reform and 'Quality Education in China: an overview. *International Journal of Educational Development*. 29, 241-249.

Eisner, E.W. (2000). Those who ignore the past…: 12 'easy' lessons fort he next millennium. *Journal of Curriculum Studies*. 32(2), 343-357.

Ensari, S., Kete, R. (2010). Lise 1. Sınıf biyoloji derslerinde ders materyali kullanımına ait öğrenci tutumları. *Kastamonu Education Journal*, 18(1), 131-146.

Ernest, P. (1988). The impact of beliefs on the teaching of mathematics. Paper presented at the 6th International Congress of Mathematical Education, Budapest, August.

Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research, 38*(1), 47-64.

Gerçek, C., Soran, H. (2005). Investigation of teachers' use of experimental methods in teaching biology. *HU Journal of Education*. 29, 95-102.

Hopmann, S.T. (2003). On the evaluation of curriculum reforms. *Journal of Curriculum Studies*, 35(4), 459-478.

Hume, A., Cole, R. (2010). Authentic student inquiry: the mismatch between the intended curriculum and the student experienced curriculum. *Research in Science and Technological Education*, 28(1), 43-62.

Jones, A., Harlow, A., Cowie, B. (2004). New Zealand teachers' experiences in implementing the technology curriculum. *International Journal of Technology and Design Education*. 14, 101-119.

Jöreskog, K. G., Sörborn, D. (1993). *Lisrel 8: Structural Equation Modelling with SIMPLS Command Language*. Lincolnwood, IL: Scientific Software International.

Kline, T. J. B. (2005). *Psychological Testing: A Practical Approach to Design and Evaluation*. Sage Publications, California.

Köseoğlu, P., Soran, H. (2004). Views on the competence of biology teachers in using material and tool. *HU Journal of Education*. 27, 189-195.

Kuiper, W., Nieveen, N., Visscher-Voerman, I. (2003). Curriculum development from a technical-professional perspective. In J. Van den Akker, W. Kuiper and U. Hameyer (Eds.) *Curriculum landscapes and trends* (pp.177-198). Dordrecht: Kluwer Academic Publishers.

Lewthwaite, B., (2005). 'It's more than knowing the science': a case study in elementary science curriculum. *Canadian Journal of Science, Mathematics and Technology Education*, 5(2), 171-186.

Mansour, N. (2010). Science teachers' beliefs and practices: issues, implications and research agenda. *International Journal of Environmental and Science Education*. 4(1), 25-48.

Miles, M. B., Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: SAGE

Ministry of National Education, MNE, (1993). *Model for curriculum development*. Ankara.

Ministry of National Education, MNE, (1998) *T. C. Milli Eğitim Bakanlığı Tebliğler Dergisi.* 61(2485).

Ministry of National Education, MNE, (2007), 9. sınıf biyoloji dersi öğretim programı, 9th grade biology curriculum, Ankara: MNE.

Ministry of National Education, MNE, (2008a), 10. sınıf biyoloji dersi öğretim programı, 10th grade biology curriculum, Ankara: MNE.

Ministry of National Education, MNE, (2008b), 11. sınıf biyoloji dersi öğretim programı, 11th grade biology curriculum, Ankara: MNE.

Ministry of National Education, MNE, (2009), 12. sınıf biyoloji dersi öğretim programı, 12th grade biology curriculum, Ankara: MNE.

Ministry of National Education, MNE, (2013),Ortaöğretim biyoloji dersi (9,10,11 ve 12. Sınıflar) öğretim programı, Secondary school biology curriculum (9,10,11 and 12th grades), Ankara: MNE.

Munby, H., Cunningham, M., Lock, C. (2000). School science culture: A case study of barriers to developing professional knowledge. *Science Education,* 84, 193–211.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19(4), 317–328.

Özbaş, G., Soran, H. (1993). A comparison of teaching biology in public, private and Anatolian schools. *HU Journal of Education*. 9, 263-270.

Öztürk, E., (1999). *Teacher roles in high school biology curriculum implementation*. Unpublished master thesis. Middle East Technical University, Ankara: Turkey

Öztürk, E., (2003). An assessment of high school biology curriculum implementation. Unpublished PhD Dissertation. Middle East Technical University, Ankara: Turkey. http://etd.lib.metu.edu.tr/upload/728428/index.pdf?origin=publicationDetail

Öztürk Akar, E., Yıldırım, A. (2011). Influence of teacher perceptions of students on teaching high school biology. *Eğitim Araştırmaları-Eurasian Journal of Educational Research,* 44, 19-32.

Öztürk Akar, E. (2013). Biology Teachers' Perspectives of Constraints Operating on Curriculum Implementation. ISNITE'2013: International Symposium, New Issues on Teacher Education, Hacettepe University, Ankara, Turkey.

Patton, M.Q., (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA. Sage.

Pinto, R. (2005). Introducing curriculum innovations in science: identifying teachers' transformations and the design of related teacher education. *Science Education*. 89, 1-12.

Roehrig, G. H., Kruse, R. A., Kern, A. (2007). Teacher and school characteristics and their influence on curriculum implementation. *Journal of Research in Science Teaching*, 44(7), 883-907.

Rogan, J. M. (2007). How much curriculum change is appropriate? Defining zone of feasible innovation. *Science Education*. 91, 439-460.

Rogan, J. M., Grayson, D. J. (2003). Towards a theory of curriculum implementation with particular reference to science education in developing countries. *International Journal of Science Education*. 25(10), 1171-1204.

Şahin, İ. (2010). Curriculum assessment: constructivist primary mathematics curriculum in Turkey. *International Journal of Science and Mathematics Education*, 8(1), 51-72.

Schneider, R. M., Krajcik, J., Blumenfeld, P. (2005) Enacting reform-based science materials: the range of teacher enactments in reform classrooms. *Journal of Research in Science Teaching*. 42(3), 283-312.

Squire, K. D., McKinster, J. G., Barnett, M., Luehmann,A. L., Barab, S. L. (2003). Designed curriculum and local culture: acknowledging the primacy of classroom culture. *Science Education*, 87, 468-489.

Stoffels, N., T. (2005). "Sir, on what page is the answer?" Exploring teacher decision-making during complex curriculum change, with specific reference to the use of learner support material. *International Journal of Educational Development*, 25, 531-546.

Tabachnick, B.G., Fidell, L.S., (2007). *Using multivariate statistics*, 5th Ed. Pearson, Boston.

Taşçı, G., Yaman, H., Soran, H. (2010). Review of status regarding biology teachers' using new technologies in education. *HU Journal of Education*. 38, 267-278.

Turkish Statistical Institute (TSI), (2011). Annual Handbook of National Statistics Poll. Ankara.

Tytler, R. (2007). School innovation in science: a model for supporting school and teacher development. Research in Science Education. 37, 189-216.

Van Den Akker, J.J. (1998). The science curriculum: Between ideals and outcomes. In B. Fraser and K. Tobin (Eds.) *International handbook of science education* (pp.421-447). Dordrecht: Kluwer Academic Publishers.

Van Den Akker, J.J. (2003). Curriculum perspectives: An introduction. In J. Van den Akker, W. Kuiper and U. Hameyer (Eds.) *Curriculum landscapes and trends* (pp.1-11). Dordrecht: Kluwer Academic Publishers.

World Bank (2005). Turkey—Education Sector Study Sustainable Pathways to an Effective, Equitable, and Efficient Education System for Preschool through Secondary School Education, Report No. 32450-TU.

Yager, R. E., Lutz, M. V. (1994). 'How' versus 'What'. *School Science and Mathematics*, 94(7), 338-346.

Yılmaz, M. (1998). *The effects of changing educational systems on biology education in high schools.* Unpublished master thesis. Hacettepe University, Ankara.

Zembylas, M. (2002). The global, the local, and the science curriculum: a struggle for balance in Cyprus. *International Journal of Science Education*, 24(4), 499-519.

Zhang, B., Krajcik, J., Wang, L., Hu, J., Wu, J., Qiang, Y., et al. (2003). Opportunities and challenges of China's inquiry-based education reform in middle and high school: Perspectives of science teachers and teacher educators. Paper presented at the American Educational Research Association Annual Meeting, Chicago, April.