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Curriculum Proposal for Science-Teaching Courses in Primary School Teacher Training[1]

Research Article

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ABSTRACT

The objective is to review the curricula for Science and Technology Teaching I and II courses included in the Undergraduate Programs for Primary School Teachers in Turkish Faculties of Education, with reference to their objectives, contents, learning-teaching process involved, and the assessment procedures, and to come up with a curriculum proposal for these courses. The data obtained through case study were reviewed through descriptive analysis. Through the study which commenced in 2013, it was observed that a definite curriculum did not exist with respect to Science and Technology Teaching I and II courses, and that the curricula implemented by the teaching staff as part of the Undergraduate Program for Primary School Teachers failed to meet the requirements expected of the prospective primary school teachers. In this context, the researchers developed a Curriculum Proposal for Science-Teaching Courses in the Undergraduate Program for Primary School Teachers. The curriculum designed with the implementation of Demirel's DEPGEM model, for Science-Teaching I and II courses is based on a progressive education philosophy emphasizing a constructivist approach and student-centric education. The Science-Teaching Curriculum thus designed entails the statement of 13 objectives and 80 learning outcomes with reference to cognitive, affective, and psycho-motor aspects, as well as 15 topics and their sub-headings in line with the objectives, along with 17 principles regarding the learning-teaching process and 13 principles regarding the assessment process.

Keywords:
Primary school teacher, science teaching, curriculum design, teacher training

Introduction

One of the deciding factors to set the level of quality and effectiveness of education is the quality of teachers. The question is about the requirements the 21st Century expects of the teachers involved in both the

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children's and adults' education. The policies concerning the development of teachers' qualifications as well as the teaching profession itself exhibit substantial variation thanks to the variations observed from one society to another (Eötvös Loránd University EDiTE team, 2014, pp. 3-4). The development of programs to train teachers, in line with the policies regarding the development of teachers' qualifications and the teaching profession itself, can also be considered as a requirement.

It is only natural that the better the program design and development process, the more qualified would be the trained teachers. The best education can be possible only with best teachers. The development of the teachers, in turn, is possible through high-quality programs implemented in the higher-education processes (Özcan, 2011, p.19).

There are numerous grounds for the design and development of curriculum for teacher training. In Turkey, the restructuring process initiated in 1997 with respect to teacher training revealed the need for programs regarding teacher training, in the light of the developments and fundamental requirements regarding teacher training and the problems observed with the undergraduate and graduate programs training teachers (Kavak, Aydın and Akbaba Altun, 2007, p. 51).

Science literacy levels of primary school teachers in Turkey stands out as a widespread problem (Türkmen, 2007). With a view to presenting solutions to the problems primary school teachers experience in the field of science, and in terms of instilling science literacy skills among their students, it is deemed necessary to review and improve the curricula regarding science teaching as already in place in the Primary School Teacher Undergraduate Programs in the Faculties of Education at universities. In order to train effective teachers, one should question the undergraduate level science teaching practices, and to prepare the teaching staff to the science of the future. For teachers who received a substantial training are expected to raise conscious and productive as well as questioning students who would contribute to almost all aspects of life (Driel and Abell, 2010, p.177). Vertical mobility requires compatibility between the undergraduate programs training the teachers, and the curricula they teach at the schools they are thereafter assigned to. The model to serve as the framework of the science teaching curriculum to be developed for prospective teachers is as crucial as the curriculum itself.

The models are defined as mental descriptions enabling the comprehension of concepts beyond direct experience or observation. The curriculum development models, in turn, assist designers in planning with the justifications for the employment of specific teaching, learning, and assessment approaches (Correia, 2014, p.115). Curriculum development is essentially a pattern which can be expressed in the form of a diagram or in words, constituting the basis of a conceptual framework or a program development process. These models (Ishemo, Kira and Komba, 2012, p.7);

1. Can lead the way for various components of the curriculum.
2. Demonstrate various stages of the curriculum development process.
3. Provide the framework for curriculum activities.
4. Establish the relationship between the components of the curriculum development process.

The curriculum design process is implemented in stages. No curriculum development model can be deemed better than others in terms of being a direct match for a specific case. A flexible model to be composed of a number of distinct curriculum models can be employed instead (Ishemo, Kira and Komba, 2012, pp.12-13).

A number of models were developed worldwide by a number of researchers, with reference to the curriculum development process. The curriculum models thus developed are often referred to with the name(s) of their designer(s). To name a few, one can mention Taba, Tyler, Taba-Tyler, Tanner and Tanner, Kerr, and Davies curriculum development models (Sezgin, 2000; Oliva, 2005; Dibisa, 2010; Lunenberg, 2011b;

Lunenberg, 2011a; Ishemo, Kira and Komba, 2012; Tyler, 2013; Demirel, 2014).

It is only natural that the better the program design and development process, the more qualified would be the trained teachers. In Turkey, Faculties of Education are the entities which are positioned best in terms of program development and evaluation. For the Faculties of Education ensure the execution of these processes in the hands of more specialists, providing a more effective process overall. The design of curricula for Science and Technology Teaching courses in the Primary School Teacher Training Undergraduate Programs of the Faculties of Education, as well as the curriculum development model to be implemented through that design are expected to facilitate the process for teaching staff, and to contribute to the teacher training system and Curricula and Teaching domain in Turkey.

The aim of the present study is to review the curricula for Science and Technology Teaching I and II courses included in the Undergraduate Programs for Primary School Teachers in Turkish Faculties of Education, with reference to their objectives, contents, learning-teaching process involved, and the assessment procedures, and to come up with a curriculum proposal for these courses.

Methodology

Research Model

The present study makes use of case study, one of the qualitative research models. It entails the longitudinal review of a case or event, and may produce an extensive volume of data which does not help with the ease of analysis (Davey, 2009). The case study process employed the "data diversity" method in the gathering of data for the study. The data trilogy employed within the framework of case studies entails reference to three or more sources to point at a given event, concept, or set of interpretations, in order to reach to concurrence at the desired point. The method employed considers data received from three distinct but concurring sources as robust inputs (Yin, 2012, pp.13-104).

Participants in the Study

Participants of the research were instructors who offered science-teaching courses in the Faculties of Education of Anadolu University and Eskişehir Osmangazi University in academic year 2013-2014, as well as instructors who have expertise in courses related to science-teaching in various universities of Turkey. Furthermore, second, third and fourth year undergraduate students of the said faculties, and primary school teachers in the primary schools in Tepebaşı and Odunpazarı districts, reporting to the Education Directorate of Eskişehir took part in the study. The participants were selected using stratified sampling from among the criteria and probability based sampling methods.

Data Collection Process

In this study, data were obtained by using literature search; the analysis of Council of Higher Education (YOK) and universities website documents; observation data obtained from courses like Science and Technology Teaching I and II, Science and Technology Labratory Applications; Primary School Teaching second, third ve forth grade preservice teachers, studied with the specified curriculum and assigned teachers and faculty members gathered from the specified course of conduct focus group discussion and semi structured interview records were utilized for the process of determining curriculum requirements. The data were supported by quotations from the researcher's diary. In the 2013-2014 academic year, Science and Technology Teaching I and II and Science and Technology Laboratory Applications II courses presented to the preservice teachers at two different universities were observed in the form of non-participant observations with detailed observation form prepared by the researchers. A total of 38 days (4212 min.) observations were made in three different courses. Semi-structured interviews were conducted with 22 teachers in the period of 16.06.2014-24.06.2014 and 9 instructors in the period of 11.03.2015-27.05.2015. Also on 22.05.2014 and

29.05.2014 with preservice teachers the focus group interviews were conducted in such a way that each group consisted of nine people.

The program design and model was developed by the researchers, in line with the qualitative data obtained through the process to identify the requirements of the program. In the process, the curriculum development models were reviewed within the framework of the document review, and the model selected for curriculum design as well as the design itself which came to be with reference to the model were created by the researchers.

Once the curriculum design was developed, the teaching staff which offer the courses, and the teaching staff which have been trained in the field of science and which have expertise in curricula and teaching came together in a workshop, to voice their expert opinions. In the course of the two-day workshop, researchers first made oral presentations, then written documents on the overall program design, the stage of determining the need, purpose, content, learning-teaching process and evaluation dimensions were given to participants. Prof. Dr. Özcan Demirel's program evaluation model (2012) was adopted and basic questions were prepared by the researchers, directed to the lecturers and the instructors were provided with the program design based on Demirel's program evaluation model (2012). In this context, the draft and the model of the curriculum was subjected to a more comprehensive and reliable feedback and revision process, and underwent review by three distinct groups each of which included approximately 7 experts out of the group of 23. The Science Teaching Courses Curriculum design and model was subjected to relevant revisions by the researchers, as per the experts opinion gathered through the workshop event.

Data Analysis

The data analysis was performed in two stages, including the analyses carried out within the framework of the data gathering process, and the analyses performed after the gathering of data. Descriptive analysis was employed in the analysis of qualitative data.

In order to examine the curricula of the courses of Science and Technology Teaching I and II, firstly, a search of the literature was carried out and a document review was carried out. In 2013, the website of the YÖK was reviewed, and no curriculum on science and technology teaching could be found in the Undergraduate Programs for Primary School Teachers which is being carried out in the Education Faculties. The website of the YÖK was also reviewed in 2014 and 2015, but it has been understood that no updates have been made to the curriculums related to science and technology teaching offered in the Undergraduate Programs for Primary School Teachers at the Faculty of Education.

ÖSYS guide for the academic year 2014-2015 were examined and through this guide has been reached 73 universities Undergraduate Programs for Primary School Teachers teaching programs in the Faculty of Education in Turkey. In this direction the web pages of relevant units of the universities were examined by the method of document review. No currciculum on science and technology teaching could be found in the university's web pages in the Primary School Teachers Progam in Teacher Education.

Observation and interview data were analyzed with Nvivo 10 qualitative data analysis program. While analyzing according to the form of observation that the researcher has formed, 30% of the observations were microanalyzed by two field experts. In this context, Miles and Huberman (1994) were used as the reliability coefficient between the coders. As a result of the calculations made, the reliability of the observations was 92% and the research was accepted as reliable. The reliability of the interview data was 94% and the study was considered reliable.

Findings

The requirements setting process for the study entails very extensive findings. These findings are referred to briefly when discussing the curriculum model, with reference to the contents of the paper.

The Science Teaching Courses Curriculum Proposal designed by the researchers, regarding the courses concerning science teaching, to be offered as part of the Primary School Teacher Training Undergraduate Programs at the Faculties of Education, is intended to be based on the following model.

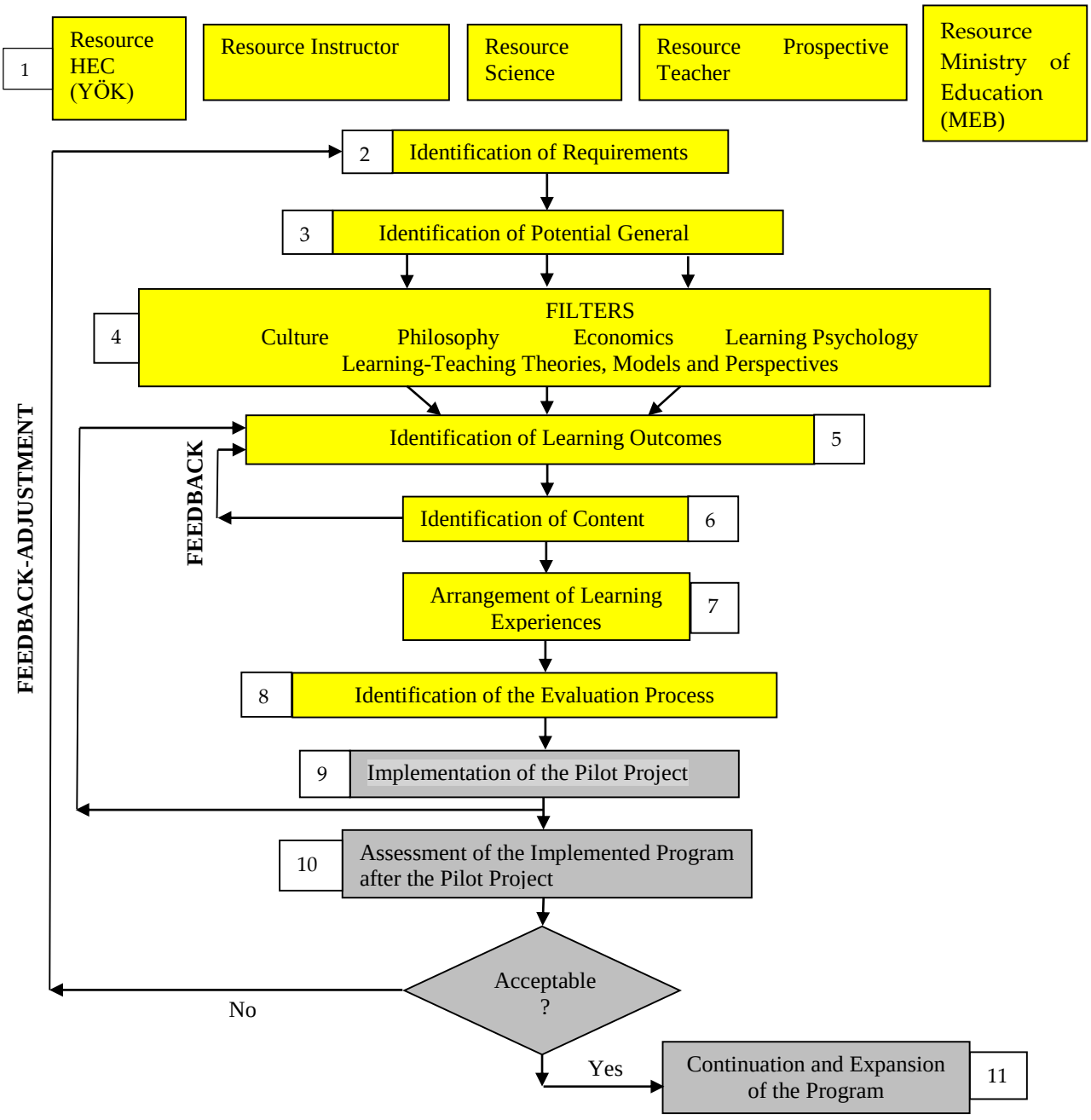

Figure 1. *Curriculum Proposal Model for Science-Teaching Courses in the Undergraduate Program for Primary School Teachers.*

The Model Adopted for Curriculum Proposal

Science Teaching Courses Curriculum is designed as a holistic program covering Science Teaching I and II courses. For the purpose of this curriculum proposal is to come up with a flexible curriculum proposal to

provide guidance for teaching staff. The model developed for the education and teaching activities to be organized for the junior year of the Primary School Teacher Training Undergraduate Program at the Faculties of Education of the Universities, entails eleven stages. It is designed with reference to the stages specified by the "Educational Curriculum Development Model (DEPGEM)" developed by Prof. Özcan Demirel. However, some stages of the said model were revised in line with the objectives of the study. As a model similar to Taba-Tyler Curriculum Development Model, Demirel's work is noted to get most of its inspiration from the development of teacher training programs implemented in Turkey (Demirel, 2014, p. 58). DEPGEM was chosen as the basis of the model design, in light of this remark, as well as due to the fact that it covers the four fundamental aspects of an education program.

In contrast to DEPGEM, this model entails more feedback-adjustments, aims for instilling a cyclical nature in the program, and enabling the rearrangement of the program design in accordance with the changes and developments to arise in the primary school level as well as in the higher education level. Furthermore, the present model entailing a focus on processes as described with DEPGEM, stands in contrast to DEPGEM due to the use of filters. It is possible to see the filter stage in Tyler's Curriculum Development Model. The intention to instill a level of flexibility in the curriculum is the reason why the present curriculum proposal entails a lower number of stages in contrast to DEPGEM.

As Figure 1 suggests, the curriculum model involves eleven stages. Stages 9, 10, and 11 of the process are shown with gray as they will be implemented after curriculum design phase of the process.

Approach Adopted for the Science Teaching Courses Curriculum Proposal Developed for Prospective Primary School Teachers

According to the programs based on the science-technology and social perspectives in the US, the science teaching program states that science is intended for all students. These programs are shaped on the basis of the will to direct the students to learning about tech-based science topics in a social framework (Colburn, 2003). The present curriculum proposal also emphasizes the need to channel science in a perspective available for all prospective teachers and the students they will be educating. Furthermore, the curriculum emphasizes science literacy among individuals, provided that certain characteristics such as the cultural and economic factors in Turkey are taken into consideration, alongside the point mentioned with reference to the curricula in the US. Therefore, the curriculum design is built around student-centric, objective- and process-based approaches.

One can argue that the approach implemented in the curriculum proposal is actually a constructivist one running in parallel to the curriculum for primary school Science courses. While the constructivist approach puts the learner at the focus of the curriculum, the objectives are set on the basis of the process and with a view to achieving a higher level of learning. The contents of the curriculum are arranged with reference to the interests of the learners, and in connection with real life cases. It also requires the planning, implementation, and evaluation of the learning-teaching process and the performance of the evaluation activities with the learners themselves (Çelik, 2006). It is noted that the curriculum of primary school Science and Technology courses aims, on the one hand, to present the knowledge in the field of science as "best explanations our current level of knowledge enables" rather than "unchangeable facts", on the other, seeks to ensure that scientific methods take hold around the axis of science literacy (MEB, 2005, pp.7-8). The primary school Science curriculum, as updated in 2013, in turn, emphasizes an investigative-inquisitive learning attitude which can still be considered to lay within the bounds of the constructivist approach. As was the case with the primary school Science and Technology curriculum published in 2005, the updated Science curriculum refers to science literacy in stating the vision of the program. However, the vision statement as updated in 2013 reads "science-literate individuals who have an investigative-inquisitive attitude, taking effective decisions, able to solve

problems, are self-confident, able to establish effective communications, engage in lifelong learning with an awareness of sustainable development, harbor, against this background, the knowledge, skills, positive attitudes, perceptions and values regarding sciences, as well as psychomotor skills and attitude regarding the relationship between the sciences and technology-society-environment." (MEB, 2013, p.1). Therefore, the Science Teaching Courses curriculum proposal developed for prospective primary school teachers should take into account a perspective to focus on science literacy, enabling the prospective teachers develop the characteristics expected of science-literate individuals.

The curriculum proposal is developed with reference to a pragmatic philosophy aiming to raise individuals who are aware of and able to utilize the means to obtain knowledge, and who organize and produce new knowledge, as well as reflecting this perspective on the training of primary school teachers. The ultimate aim is to raise individuals who learn through performance and experience in line with this philosophy. Even though the curriculum proposal embraces pragmatic philosophy, other philosophical perspectives will also be taken into consideration through the process.

The curriculum thus designed attaches great importance to objectives which take kinesthetic (psychomotor) aspect into account, as well as to affective objectives, alongside the cognitive ones. For contemporary progressive attitudes presenting a humanitarian education perspective and underlining a humanitarian program make a point of emphasizing affective outcomes in addition to cognitive ones (Ornstein and Hunkins, 2009).

The Science Teaching curriculum developed for prospective primary school teachers is designed as a student-centric program. For, the most important aspect of the student-centric curriculum proposal is not about content or learning objectives, but rather the learner herself. A constructivist curriculum proposal offers learning experiences to support the learners in terms of their development as creative and independent learners (Quoted from Harris, Cullen, and Hill, 2012 by Correia, 2014, p. 115). The student-centric education perspective reflects the educational philosophy of John Dewey. According to his philosophy, student-centric education is based on experiences, built with reference to the experiences people have gathered so far in their lives, with a view to enabling people to learn through interaction with the environment. Moreover, student-centric education focuses the Socratic teaching methods entailing practice and reason based learning, as well as indirect teaching methods (Colburn, 2003, pp. 11-12). The steps involved in the model developed for the curriculum proposal are discussed briefly below.

1.References

Turkish institutions such as the Ministry of Education and the Council of Higher Education harbor a perspective whereby the domain of science, the lecturers offering the science teaching courses in the undergraduate program for primary school teachers, and the prospective teachers being taught in those programs are deemed as the sources of reference for the Science Teaching Curriculum. Prior to the process of identification of requirements regarding the curriculum design, as well as during the process itself, these sources were consulted in the efforts to formulate the proposal.

2.Identification of Requirements

The identification of requirements can be considered as the most time-consuming aspect of research, where, nonetheless, comprehensive findings are reached. The research sought to identify the requirements by employing a democratic perspective among the alternative perspectives to identifying requirements for the Science Teaching Curriculum proposal. The work on the identification of requirements commenced in the academic year 2013-2014, and were completed in 2014-2015. Within the framework of requirement identification efforts, literature survey and document review were carried out first, followed by observations and interviews to gather research data. The data was supported further with the researcher's journal.

The literature review led to no official document providing a detailed definition of the aspects of the curricula for Science and Technology Teaching I and II courses offered as part of the Primary School Teacher Training Undergraduate Programs of Turkish Faculties of Education. The academic studies on this topic are simply considered insufficient.

The document review efforts focused first on the web site of the Council of Higher Education (YÖK). The latest updates noted by YÖK led the researchers to the Teacher Training Undergraduate Programs of the Faculties of Education. The review of the pages presenting such programs, in turn, led to the conclusion that they contained only the names, descriptions, and contents of the courses. Furthermore, it was observed that a total of 73 universities offered Primary School Teacher Training Undergraduate Programs in their Faculties of Education during the academic year 2014-2015 (ÖSYM, 2014). In this context, the web pages regarding the Primary School Teacher Training Undergraduate Programs of YÖK as well as the Faculties of Education of the said set of universities were reviewed. Out of 73 state and private universities 49 were found to provide information on the aspects of a curriculum such as the objectives and contents of the Science and Technology Teaching I and II courses within the framework of the Primary School Teacher Training Undergraduate Programs offered by their Faculties of Education, whereas 24 universities did not. One can confidently state that a curriculum document providing an exhaustive description of the curricula for the Science and Technology Teaching I and II courses offered within the framework of the Primary School Teacher Training Undergraduate Programs, covering all four fundamental aspects of a curriculum, namely objectives, contents, learning-teaching process, and evaluation.

Nine lecturers were also consulted with respect to the existence of a curriculum regarding Science and Technology Teaching I and II courses. Eight of the lecturers consulted stated that no curriculum was in existence for Science and Technology Teaching I and II courses, while one stated the sources of reference she employed for the course, rather than referring to a specific curriculum.

During the efforts to identify requirements, the researcher made observations on the Science and Technology Teaching I and II as well as Science and Technology Laboratory Practices II courses offered to prospective primary school teachers at two distinct universities in the academic year 2013-2014. The lecturers offering the course during the observation process were found to have employed the curricula themselves had designed and published on the web sites of the universities. In a nutshell, the Primary School Teacher Training Undergraduate Programs offered by the Faculties of Education were found to be based on the curricula developed by the lecturers with reference to their own experiences and qualifications, whereas the list of contents published by YÖK and the teacher qualifications published by the Ministry of Education were found to be the only documents or records regarding the curricula.

3.Identification of Potential General Objectives

An education sociologist and philosopher, as well as an education economist, and a learning psychologist were consulted about the potential general objectives and learning outcomes of the program. Said experts were understood to have approved of the potential general objectives and the learning outcomes of the program; small revisions were nonetheless effected on the proposal, in line with their comments. Furthermore, two lecturers who exhibit qualifications in parallel to those of the consulted lecturers were consulted once again, with reference to the final form of the draft.

4.Filters

The general objectives of the curriculum proposal were established in line with the requirements identified. In the widest sense, the aim of the Science Teaching Courses Curriculum is to enable prospective primary school teachers to be aware of the developments worldwide, supporting a culture of knowledge, research, and science, and to improve their attitudes towards science. The curriculum thus designed was

envisaged to take two semesters as Science Teaching I and Science Teaching II courses, with reference to 13 general objective statements. These objectives were then categorized under three sections as "Shared Skills for Science Teaching I and II Courses", "Science Teaching I", and "Science Teaching II course".

5.Identification of Learning Outcomes

In line with the requirements identified, the behaviors prospective teachers are expected to exhibit are expressed as learning outcomes rather than objectives or achievements, on the basis of the expressions embraced by the Bologna Process. 80 learning outcomes were presented, provided that affective and psychomotor-related learning outcomes were included alongside those concerning the cognitive domain.

6.Identification of Content

The content was discussed with reference to 15 general topics and sub-headings covering issues such as the historical development of science and the nature of science, science literacy, and the introduction to Science course curricula for years 3-8 of primary and secondary schools.

7.Arrangement of Learning Experiences

The learning-teaching process, on the other hand, was based on the statement by the researchers, of 17 principles the teaching staff are required to take into account to enable the implementation of a flexible learning-teaching process. Deemed one of the most popular sections of the proposal, these principles served to emphasize the requirement expected of the lecturers –namely providing learning experiences to prospective teachers during the learning-teaching process, to emphasize observation, review, investigation-inquiry, and experimentation as well as model or project design. Furthermore, a multitude of activities were developed by the researchers for the organization of learning experiences, and the proposal was enriched with links to web sites and blogs deemed helpful to teaching staff in this context.

8.**Identification of the Evaluation Process**

The proposal defines 13 principles required to be taken into consideration with respect to the evaluation stage of the Science Teaching Courses Curriculum. Given the existence of the teaching aspect of the Science Teaching I and II courses as part of the evaluation process developed to coincide with the objectives of the program, the process-based evaluation covering the complementary evaluation-assessment perspective, and the performance-based considerations in this context, were emphasized.

9.Implementation of the Pilot Project

The program thus developed will be tried as part of the Primary School Teacher Training Undergraduate Programs of the Faculties of Education to be selected randomly. During the implementation of the pilot practice, as well as in its conclusion, feedback will be sought, and will be used to shed light on a revision of the identification of learning outcomes in case deficiencies or errors were observed.

10.Assessment of the Implemented Program after the Pilot Project

A survey can be applied with prospective primary school teachers to enable an evaluation of the program implemented on a pilot basis. The lecturers may also be asked to fill out self-assessment forms to shed light on their progress in the teaching process. Semi-structured interviews may be performed with lecturers and students. The lecturers may be asked to keep diaries to note the shortcomings and problems they observe with the Science Teaching courses, as well as the different learning experiences they come across. Delphi technique can be employed to enable the lecturers discuss the statements they recorded on their diaries, in a virtual environment. The revisions required as suggested by the assessment of the draft program will be effected, followed by the decision to maintain the program in place. It is crucial to take into account any changes or developments taking place, when applying the revisions in question.

11.Continuation and Expansion of the Program

In case the results obtained in line with the findings regarding the program implemented through the pilot application and evaluation processes are positive, the decision to continue the implementation of the program will be taken. In case the results are deemed insufficient or negative, one should expect a thorough revision of the program, starting with the identification of requirements. At this stage, a group composed of lecturers offering science teaching related courses in Turkey may be brought into existence to enable a continuous evaluation of the program using digital product files on the internet. The continuous feedback is believed to contribute to increasing the strength and sustainability of the program.

Conclusions and Recommendations

The Science and Technology Teaching I and II courses currently offered as part of the Primary School Teacher Training Undergraduate Programs by Faculties of Education in Turkey are understood not to be based on a specific curriculum. In this context, a Science Teaching Courses Curriculum proposal was developed, covering the courses included in the said undergraduate program.

The program model applied for the Science Teaching Courses Curriculum proposal was designed as a flexible construct comprised of eleven stages, taking into account the stages the "Educational Curriculum Development Model (DEPGEM)" by Demirel; it is based on the fundamental elements of a curriculum comprised of objectives, content, learning-teaching process, and evaluation in line with the requirements identified. DEPGEM, in turn, is comprised of five sections –planning of curriculum development efforts, preparation of the draft curriculum or the commencement of the curriculum development activities, pilot-trials of the curriculum at schools, implementation of the curriculum and a general assessment of the implementation– divided into fifteen stages.

While DEPGEM was observed to commence with the process with the identification of needs as was the case with Taba-Tyler curriculum development model. The latter model is understood to help in the identification of requirements by employing five distinct resources. The model developed with a focus on the process for higher education employed a pragmatic philosophy and a constructivist approach, but tried, in contrast to DEPGEM, to achieve a cyclical nature for the curriculum, providing more room for filters and feedback-revisions.

When compared against the curriculum development perspectives in the literature, the theoretical foundations of the curriculum development models in place in Turkey exhibit a more traditionalist and behaviorist perspective focusing on issue areas, academic, systematic, cognitive, transmitting and product-based curricula approaches based on planning, a systematic attitude, objectivity, rationality, objective and issue-area as well as specific elements based program outlooks and curriculum development insights (İşeri, 2015, p. 1420). The program model entailed in the present study, in turn, employs a inductive approach starting with the identification of requirements, exhibits a cyclical nature with feedback and revisions, and focuses on the learner rather than the issue area, and hence stands in contrast to the dominant paradigm in Turkey.

The curriculum proposal thus prepared can be called a constructivist approach running in parallel to the primary school Science curriculum, and can be commended for the student-centric, and objective and process based approaches it exhibits. Recent years saw a focus on the constructivist approach requiring the structuring of all elements of the curriculum, based on new values regarding learning, putting to the forefront the process to enable best learning by the individual, and how to arrange the learning experiences for this purpose (EARGED, 2007, pp. 36-37). The constructivist approach regarding the program development process emphasize the need for the use of a rich learning environment and a wealth of materials, to render the information meaningful and useful through the learning-teaching process (Erdem and Demirel, 2002, pp. 86-87).

The proposal underlines the science literacy skills on part of the prospective teachers, and employs pragmatic philosophy in relation to the aim of raising individuals who can learn through experience. Alongside the pragmatic philosophy, other philosophical perspectives will also be taken into consideration through the process. One can argue that White's (1988 quoted by Demirel, 1992) views regarding the British education system runs in parallel to the philosophy of the program. According to white, the curriculum development activities reflect value analyses and ideologies, whereas their philosophical foundations extend to classical humanism, progressivism, and re-constructionism (Demirel, 1992, p. 35).

The Science Teaching Courses Curriculum proposal entails 13 objective statements and 80 learning outcomes taking into account cognitive as well as affective and psychomotor (kinesthetic) aspects. These objectives were then categorized under three sections as "Shared Skills for Science Teaching I and II Courses", "Science Teaching I", and "Science Teaching II course". It can be said that the statements of purpose and learning outcomes are also overlapped with the curriculum of the science course published in 2018. Minor changes in the design may be made, such as emphasizing engineering and design skills expressions. Even though primary and secondary school science curriculum published in 2018 includes the purpose of taking into consideration the skills indicated in this draft for the addition of engineering and design skills (MEB, 2018) to the skills mentioned in 2013.

The contents refer to 15 topics and sub-headings, while the learning-teaching process, was based on the statement by the researchers, of 17 principles the teaching staff are required to take into account to enable the implementation of a flexible learning-teaching process. Given the existence of the teaching aspect of the Science Teaching I and II courses as part of the evaluation process developed to coincide with the objectives of the program, the process-based evaluation covering the complementary evaluation-assessment perspective, and the performance-based considerations in this context, were emphasized. Furthermore, the proposal defines 13 principles required to be taken into consideration with respect to the evaluation stage of the Science Teaching Courses Curriculum. The Science Teaching Curriculum proposal also includes annexes containing a sample course plan and attitude scale, as well as tools such as the peer evaluation form.

The Science Teaching Courses Curriculum Proposal thus developed;

- is expected to contribute to the development of science literacy skills on part of prospective primary school teachers, and to the instilling of knowledge, skills and attitudes on how to adopt the primary school Science curriculum to their actual classroom environments when taking on the teaching profession.
- can be implemented through action research.
- requires the preparation of course plans putting the prospective teachers to the center, and emphasis on the issues raised in the proposal, such as the provision of suitable laboratory environments and opportunities at Faculties of Education, to render it effective.

In 2018, the curriculum of the 25 undergraduate programs under the coordination of Council of Higher Education was updated (YÖK, 2018). The content of “Basic Science in Primary School” and “Science Teaching” courses and the contents of “Science and Technology Teaching I and II” courses are similar in Primary School Undergraduate Programs, which are put into practice as of 2018-2019 academic year.

*Although the curriculum design is not fully covered in this study, the general outline of the curriculum design is presented. It is considered that the design will be an example for the instructors.

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