Analysis of Pre-Service Science Teachers' Perceptions About The Project Concept Using Word Association Test And Concept Maps

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1. Introduction

The project concept in education is generally defined as the process by which students study individually or in small groups in order to present a concrete product [1]. During this process, students develop projects by noticing a problem and finding a solution or solutions regarding that problem, and gain life experiences, are actively involved in the process during problem solving and learning, improve their skills in creating different solutions, and conduct research and inquiries. Thus, it is of great importance that teachers guide students well during this process. It is emphasized in the science and technology curriculum, which has been applied gradually since the 2005-2006 academic year in Turkey, that appropriate learning settings should be prepared by letting students engage in project work [2]. Therefore, it is essential to determine pre-service teachers' level of knowledge, background and experience and their perception of this concept.

One of the tools used to determine pre-service teachers' perceptions of the project concept in the study is word association tests. In literature, it is seen that word association tests are generally used for examining students' cognitive structures for any concept or determining their level of understanding [3, 4, 5, 6]. According to Bahar and Özatlı (2003), word association tests request the students write down those concepts which come to their mind when a key word is given on any issue within a specific time [3]. Scoring is done in word association by taking into account factors such as the number of students' responses, their quality and associating two different word groups with each other [7].

One of the graphical tools that help us understand how an individual structures a concept in his mind is concept maps. Developed by considering Ausubel's meaningful learning theory, concept maps provide a visual presentation of concepts and relationships among concepts. In this respect, concept maps were used for the purpose of determining how and with which concepts or words pre-service teachers associate the concept of "project" in this study. Thus, it can be said that concept maps were used for the purpose of assessment in this study. There are different approaches for assessing concept maps in literature. One of these approaches is known to belong to Novak and Govin (1984), who introduced concept maps to the literature [8]. It is seen that in the first of Novak and Govin's (1984) suggestions for assessing concept maps, four basic criteria, propositions, hierarchy, cross-links and examples, were scored [8].

2. Method

The present study was conducted in the spring term of the 2010–2011 academic year in an Education Faculty in the Aegean Region of Turkey. The participants of the study were composed of 131 pre-service science teachers who took the Special Teaching Methods I, which is a compulsory course instructed in the second term of the third year in science education programs of education faculties in Turkey. One of the approaches in science education that pre-service teachers learn within the scope of this course is the project based learning approach. Before instructing the project based learning approach, pre-service teachers were tested with the word association test in order to determine their perception regarding the project concept and they were asked to prepare a concept map for the concept. Within this process, word association tests were done individually while concept map preparations were done in groups. Next, the project based approach along with examples of practices was instructed for four course hours. Later, pre-service teachers were given various issues in science and technology and asked to prepare projects related to them. They were given five weeks to complete their projects. At the end of this period, pre-service teachers presented their projects in groups in the classroom setting. Following the aforesaid implementation, pre-service teachers' project perceptions were measured again with word association and concept maps as done in the initial practice. Hence, pre-service teachers' perceptions for the project concept were analyzed descriptively before and after the implementation. For the analysis of the word association test, the level of relation and the number of words towards the concept of project were considered as the basis and the scoring system developed by Ormancı and Şaşmaz- Ören (2010) was used [9]. In analyzing concept maps, the four criteria (proposition, hierarchy, cross-link and examples) prepared by Novak and Gowin (1984) were used as base [8]. However, since in this study a great majority of concept maps prepared for the project concept was made as concept map that is not hierarchical (web concept map), the hierarchy score was not included in the scoring.

Twenty-five word association test results of the participants were selected randomly and analyzed before and after the implementation. A total of ten group's maps were selected randomly among the concept maps prepared in group work and analyzed in a manner that was appropriate to the criteria identified. Descriptive analysis was used in data analysis process and qualitative and quantitative assessments were done together for both word association and concept maps.

3. Findings

The findings of the study were examined under two basic headings as "pre-service teachers' perceptions towards the project concept in terms of word association test" and "pre-service teachers' perceptions towards the project concept in terms of concept maps".

Pre-service teachers' Perceptions towards the Project Concept in terms of Word Association Test

When the number of word/concepts of pre-service teachers toward the concept of project was examined, it was seen that there was an 85.4 % increase before and after the implementation. In pre-service teachers' perceptions toward the project concept, while 57 words out of 151 (37.7%) were found to be directly related before the implementation, it was seen that after the implementation, 161 words were written out of 280. Thus, it is seen that there is a 182.5 % increase in the number of words/concepts directly associated with the participants' project concept before and after the implementation.

The results of pre-service teachers' word association were examined qualitatively and it was seen that before the implementation they generally associated the project concept with words or concepts such as "engineer, architect, homework, file, thesis, drawing, picture, pattern, graphic, report, formation, and technological tools". After the implementation, pre-service teachers associated the project concept with words or concepts such as " technology, design, planning, John Dewey, research, living skills, effective learning, product, process, construction, constructivism, Bruner, in depth research, budget, timing, development, imagining, responsibility, critical thinking, scientific method, scientific process skills, and material product".

Pre-service Teachers' Perceptions towards the Project Concept in terms of Concept Maps

Table 1 shows the results of the analysis of the concept maps used to determine pre-service teachers' perceptions toward "project" concept before and after project development implementation.

Table 1. Analysis results of concept maps

Concept Map	Pre-aplication							Post-aplication						
	Prop.		Cross Link		Example		Score	Prop.		Cross Link		Example		Score
Number (N) / Point (P)	N	P	N	P	N	P		N	P	N	P	N	P	
1	6	6	1	10	0	0	16	20	20	2	12	3	3	35
2	12	12	2	12	0	0	24	34	34	5	34	3	3	71
3	6	6	0	0	4	4	10	21	21	0	0	0	0	21
4	10	10	0	0	3	3	13	17	17	5	34	1	1	52
5	6	6	3	6	0	0	12	19	19	9	66	3	3	88
6	9	9	1	2	0	0	11	29	29	1	10	0	0	39
7	6	6	3	14	0	0	20	25	25	4	24	1	1	50
8	9	9	1	2	0	0	11	27	27	6	28	3	3	58
9	16	16	2	12	1	1	29	21	21	4	16	0	0	37
10	12	12	1	2	0	0	14	23	23	2	20	4	4	47
Total	92	92	14	60	8	8	160	236	236	38	244	18	18	498

When Table 1 is examined, it is understood that there was a great increase in all parts that were used as base in concept map analysis before and after the implementation and the number of associated concepts were seen to increase. It is seen that before and after the implementation, the number of propositions increased from 92 to 236 (a 156,6% increase). There was an increase from 14 to 38 (171%) in cross links and an increase from 8 to 18 (125%) in examples. Also, when pre-service teachers' scores from cross links were examined, it was concluded that the number of links that could be considered valid and significant increased after the implementation.

The concept map analysis results were examined qualitatively and it was seen that students generally associated the project concept with concepts such as "plan, manager, thought, student, teacher, knowledge, presentation, implementation, homework, graphics, drawing, method, and experiment" before the implementation. Later, they associated the same concept with concepts such as "constructivism, cooperative learning, process, product, design, planning, construction, imagining, assessment, cost, observation, problem, daily life, questioning, lifelong learning, permanent learning, scientific process skills, and technology" following the implementation.

4. Discussion and Conclusion

The results of both the word association and concept map analyses in the present study show that the number of concepts and/or words that pre-service teachers associate with the "project" concept increased after the implementation. This is an expected result due to the fact that pre-service teachers developed projects and were instructed in the project based learning approach. However, word association and concept map analyses provide important data regarding in what way and how their perceptions have changed. For instance, when the rate of

increase in the number of words associated with pre-service teachers' total number of words was examined, the level of association of the words written with the project concept was found to be higher; that is, the number of concepts with direct relationship greatly increases. As another example, before project development practice, pre-service teachers perceive the concept of project as a file or homework. One of the reasons why the pre-service teachers' perceptions towards the project concept before implementation were formed in this way is that generally they make projects while they are students as annual homework and hence they perceive projects as an assignment or file.

Concept maps are quite useful tools to obtain both qualitative and quantitative data for students' knowledge of abstract concepts [10]. In this study, concepts maps provided both qualitative and quantitative data regarding the pre-service teachers' perceptions of the project concepts. The quantitative data obtained showed that in all parts of concept maps formed, mainly in the cross links, there was a great increase. Considering this increase in scores, it can be said that pre-service teachers' perceptions toward the aforesaid concept changed and improved quite a lot during the project development process. In this respect, it can be suggested that in order to develop perception towards any concept, an individual should practice with regards to that concept and different hands – on and minds – on activities should be developed.

The qualitative data obtained from concept maps show that while pre-service teachers associated the concept of project with general concepts such as student or teacher before the implementation of the project, they associated it with concepts such as problem, questioning, design, constructivism, scientific process skills, and lifelong learning, which cover the basic factors of the project based learning approach, after the implementation. In this respect, particularly in method courses at higher education level, practices with regards to different learning, teaching approaches, methods and strategies should be made, and also, by making use of methods and techniques as concept maps and word association test, the development of mentally constructing knowledge should be observed.

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