American Journal of Educational Research, 2015, Vol. 3, No. 10, 1243-1252
Available online at http://pubs.sciepub.com/education/3/10/6

DOI:10.12691/education-3-10-6

In Science and Maths Education, the Portfolio Implementations of Prospective Preschool Teachers

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Received August 19, 2015; Revised September 07, 2015; Accepted October 08, 2015

Abstract Although the use of portfolio in the curriculum of teacher training and evaluation process is a common method, in recent years, it is a new trend in Turkey. The purpose of this study is to display the effectiveness of portfolio implementations and evaluations on the improvement of the teaching skills of prospective preschool teachers and set forth an approach on using portfolio not only as an assessment tool based on constructivist approach but also as a teaching tool in the process of science and math education in preschool education. In this study, collaborative action research is applied with a group of volunteer preschool teachers who worked with a university professor and staff development officer. The document examination and observation methods of qualitative research were employed in this study. The study was conducted with second grade prospective preschool teachers (n=49). For this study, prospective teachers were asked to design two original experiments and materials for science and math education for children at the age of 4-6, to perform these experiments by them and children in a period of 14 weeks; and to perform these experiments at home and kindergarten in compliance with the target achievements. The experiments designed by prospective teachers were discussed with other prospective teachers in terms of being safe, economic and practicable. The experiments were performed by prospective teachers for two times; first at home and kindergarten, then at science classes. After the process of experiments and the applications of materials, the feedback obtained from children were re-evaluated by prospective teachers. Finally, the prospective teachers were asked to prepare portfolio involving their self-assessment regarding each step of the implementation process. As a result of this study, under the lights of portfolio implementations and evaluations, the improvement of the teaching skills of the preschool teachers was observed in terms of being reflective practitioners, making progress on school wide priorities and building professional culture. Finally, an approach was set forth towards the use of portfolio in the process of teacher training which paves the way for the usability of cognitive life skills at the highest level for teachers and suggestions were made.

Keywords: *preschool science and math education, portfolio, experiment, material*

Cite This Article: Belgin PARLAKYILDIZ, "In Science and Maths Education, the Portfolio Implementations of Prospective Preschool Teachers." *American Journal of Educational Research*, vol. 3, no. 10 (2015): 1243-1252. doi: 10.12691/education-3-10-6.

1. Introduction

Advances in science and technology affect all developed and developning countries.These advances cause a fast change in the social, political, economic and cultural systems in Turkey. In parallel with this, the need for education increases and the importance of investing in human beings becomes clearer. Accordingly, the everchanging world and social needs make some changes in the educational system inevitable. The traditional status of teachers as information provider has been transformed into a status of teacher as a guide to information, a facilitator of learning, and a motivator of students for thinking. Instead of rote learning, students must be trained as individuals who can reach the information, who can use this information, who can debate, who is inquisitive, who can utilize the thinking processes, and who can produce new information ([7], p. 2). Classical approaches to assessment/evaluation have been commonly used both in Turkey and abroad. They usually tend to give importance to performance or process assessment, contain questions with one correct answer such as pen and paper tests, and find out whether students remember the information given to them. Besides, genuine assessment methods offer students an opportunity of choice, collection and reflection on the things that they are to learn, that will improve students critical thinking skills, and that will motivate them to show their academik powers ignored ([1], p.103) and therefore permanent learning is achieved ([6], p.2). Starting from preschool teaching, teachers at all levels of education are interested in what students learn, and they feel the need to use suitable assessment methods in order for them to track the development of students. It is important that teachers take into account the processes of knowing and assessment of students with the process of learning, and that they consider each activity as data about students ([15], p.377). The use of alternative assessment

activities are supported by theories of learning and classroom life. On the one hand, students learn in different ways and on the other, they create information from their own experiences. Variation in types of learning and the nature of learning have obligated teachers to employ alternative assessment methods ([22], p.11). The main goal in choosing portfolio assessment from among alternative assessment methods in the present study is that it has all the characteristics of new assessment methods and that it has been widely used all over the world. Portfolios do not only assess students' knowledge and skills; they also require more effort for planning and assessment. For this reason, it is an assessment method that also teaches ways of learning ([6], p.3). What is portfolio? Portfolios have been defined differently by different researchers. Some of them are as follows; "Collection of cumulative and systematic works chosen and recommended by students, teachers or colleagues in order to assess/evaluate the development of the student's existing skills" ([19], p.85). "A teaching portfolio is the total of the documents of a teacher's in-class activities and contains lesson plans, student homework, teacher's written instructions, video cassettes and even advisor evaluations" ([23], p.35). A portfolio is a collection with a purpose which exhibits students' achievements in different areas in the process in which they are. This collection is a criterion for qualified decisions, a proof of students' own reflections, and contains students' own sections with the contents chosen" ([17], p.60). As the definitions indicate, its characteristic that improves students' creative thinking makes portfolio an alternative to the classical assessment tests ([6], p.1).

The characteristic of the present century which can be defined as "Science Explosion" makes it necessary for our children to acquire some characteristics such as scientific concepts and creative thinking in early childhood. Early childhood is a period in which a child actively acquires basic concepts and the skills of the scientific process. The experiences that the children have in this period create a suitable environment for the acquisition of the concepts. In the day-to-day life, when we observe a small child in his/her natural activities, we can see the formation of the concepts and their application in cases that require problem solving. One-to-one matching, counting, classifying, and assessment are some of these concepts ([3], p.99). The starting point of the science and maths teaching for preschool children is their natural environments. They are curious, investigative, imaginative and querier. In order to support their development in this aspect, they must be given opportunities in which they can satisfy their curiosity by investigating and making predictions by suggesting ideas. This can be achieved through "science and maths activities" that improve children's curiosity and research motives and stimulates their cognitive skills ([5], p.7). In this way, children who become familiar with scientific activities can learn and implement the scientific processes both at home and in the preschool science classes. In addition, active participation of the families in the programs of the educational institution, their familiarity with the play material and their uses, and and at least their attempt to supply children with similar material in the home environment will simply contribute to the learning process of the children ([8], p.34). Achieving a successful parent-child interaction, which can be considered as the basis for the interaction that the child will establish with other people in the future, depends if and only on the condition that the mother spares enough time for the child and meets his/her affectionately and properly. As known, parents are the first teachers of a child who help the child learn many developmental skills such as walking and speaking, and information about his/her environment. The teaching functions of the parents start from the child's birth but do not come to an end when the child starts to go to school and has a regular teacher at school ([21], p.74). In general, almost in all countries in the world, the education in the first five years of a child's life, which is the most important period, is considered to be the basic duty of the parents ([14], p.104). It has been observed that children start the process of learning their immediate environment by touching, tasting, hearing and seeing and then start to develop their skills of asking questions and doing observation-experiment. Especially in the preschool period, making the activities of science and maths education more pleasurable for children and aiming their interests, expectations and needs rather than giving them standard information when planning these activities will make science and maths education more meaningful for children and lead them to develop a more positive approach to sciences in the future [11].

1.1. The Laboratory (Experiment) Method in Science Education

Akgün [2] defines the experiment method as "experimentation whose conditions are prepared by the researcher in order to repeat the events in nature and reveal a truth in science" (cited in Arnas et al, [4], p.148). According to Kang & Wallace (2005), the laboratory method is a teaching method that develops cognitive skills and that allows for the learners to work individually or in groups. Science experiments are a necessary and indispensable part of learning experiences in science lessons. It improves the investigation and research skills of the learners and make them interested in learning and eager to learn. Science experiments which are based on learning by doing and experiencing make learning effective and lively and allows for the learner to actively take part in the learning process (cited in Küçükturan, [13], p.66). This improves learner's such cognitive skills as ratiocination, setting up cause and effect relationships, problem solving, and making generalizations. It also helps them develop positive attitudes towards using the scientific method ([13], p.66).

1.2. The Importance of Experiment in Preschool Teaching

The use of experiment method in science and maths lessons in preschool teaching is important in terms of developing children's curiosity and research motives, stimulating their cognitive skills and being successful in their school lives in the future. Children are interested in the objects and events in their immediate environment. In order to keep children's interest alive, parents and teachers should find science/maths activities that will set them in motion and that will be interesting for them. A perfect laboratory is not always necessary in order to make experiments. Especially for preschool children, there are

many experiments that can be conducted with simple materials without having a laboratory. Such things at home and in the environment as growing plants, animals, worms in the soil, wood floating on water, and sinking of a stone in water are all experiments. Children, who do not attend preschool education institutions, must also be educated by their parents at home. Science/maths activities can also be done at home ([20], p.31). One of the most enjoyable ways of involving children in science and maths is the cooking activity either at home or school. According to Jackman (2005), one may ask a child playing in a dramatic playground to explain the material in an imaginary cake that she is baking. Most of the time, the response will be like this: "I added 20 cups of sugar, some flour, and two eggs. I blended them and put the mixture in the oven for ten minutes." Even though the numerical amounts of the materials in the recipe are not correct, children are aware of the concept of amount in the recipe (cited in Kandır and Orcan, [12], p.37). The aim of conducting experiments in the science and maths lessons is not to transfer information to children by showing; the aim is for them to learn in an effective way by doing and experiencing the events related to the nature, science and maths (Arnas, [4], p.148). As seen, parents at home and teachers at school can extend such activities through play. In this way, the child improves her skills of counting-concepts-colors-shapes-matching-measuring-forming patterns-modelling-cooperation-problem solving, and in this way, contributes to her social and emotional development.

The aims of the present study are: to investigate the possible aims of science experiments and maths materials that can be conducted and used at home and school; to find out about the aspects of such experiments and materials, to which attention must be paid during implementation; to determine the advantages of using home and classroom as an experiment environment; to elicit learners' views about the portfolio implementation in science and maths instruction; and, by creating a model of education, to suggest an approach on how experiments and materials can be used as experiment tools in science and maths education. Thus, the study involves the assessment of the regular and cumulative collection of the science experiments/maths materials that the university students performed/prepared during the course using some predetermined criteria. Finally, the purpose of this study is to display the effectiveness of portfolio implementations and evaluations on the improvement of the teaching skills of prospective preschool teachers and set forth an approach on using portfolio not only as an assessment tool based on constructivist approach but also as a teaching tool in the process of science and math education in preschool education.

2. Method

The present study is an action research which is a disciplined process of inquiry conducted by and for those taking the action. Collaborative action research model is applied in this study. A group of preschool teachers worked with a university professor and staff development officer ([10], p.3). To collect data, document review and observation methods are used [24]. "Documents prove their value not only because of the things that could be learnt from them but also due to being stimulating for researchers that can only be followed by observation and contact" [18]. "Observation is a method that is used for a detailed description of a behavior that takes place in an environment or institution" ([24], p.124). This study was carried out in the Science and Maths Teaching course with the second year students (N=49) of the Department of Preschool Teaching, Faculty of Education, Istanbul Sabahattin Zaim University, in the spring semester of 2014-2015 academic year. This study was carried out with prospective teachers and the stages of the study are as follow; Prospective teachers were asked to review articles for two weeks and then design two original experiments with waste materials for science and maths classes and one maths material to be used in the science and maths class for the 3-6 age group. However, during the design process participants were warned that the experiments and material had to be in line with the gains and indicators and the students' level of education and that the material had to be waste material that can be found in the natural environment. Each experiment and material that was designed by each prospective student was discussed in the class with other prospective students by paying attention especially to reliability, economy and practicality and necessary modifications were made. When the experiments and materials took their final form, prospective teachers were asked to test them themselves at home. In this way, the stages of experiments and materials were re-checked to see whether they are suitable in terms of such aspects as timing and reliability. Then, these experiments and materials were implemented in the Science and Maths Teaching course of the fourth semester of the undergraduate program of the university and in the science and maths courses in the nursery schools/at home by children. At this stage, before the results were discussed in class, prospective teachers were asked to prepare a portfolio including their own evaluations for each stage of the implementations. Finally, prospective teachers shared with other prospective teachers their experiences in class either by implementing them or as a presentation by considering the results of their implementations of the experiments and materials. The feedback that was elicited from children after the experiments and materials were implemented was re-evaluated with prospective teachers by considering the portfolios as well. After the presentations, prospective teachers were asked to add another section into their portfolios in which they evaluated their peers, course, and the instructor of the course. In this way, they evaluated themselves, the children at school/home, and their classmates. Throughout the process, the researcher observed the implementations of the prospective teachers and took some notes. The portfolios prepared by the prospective students were collected at the end of the implementations and were anaylzed using document analysis, which is one of the qualitative research methods. When analyzing the portfolios, they were coded to make the analysis more meaningful. The portfolios were coded as P1, P2, P3, P4, and so on. The notes that were taken during the observations in the prosess and the results of the examination of the portfolios were combined and in this way the results of the improvement of the teaching skills of preschool teachers on the portfolio implementation and evaluation were observed and an

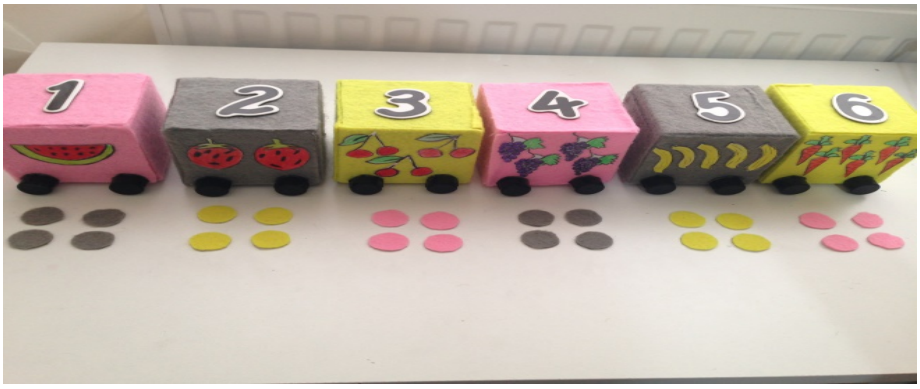
approach of "Creating Experiments and Materials for Science and Maths Course" were obtained.

3. Findings

As a result of the researcher's document review of the portfolios and observations, the findings about the aims that the experiments and materials serve were collected under the following titles.

3.1. Acquiring the Concepts

Review of the portfolios and observation data showed that through science experiments and maths materials, children can acquire especially the concepts at home/school safely and joyfully. For example; a prospective teacher taught children the concept of numbers, counting from 1 to 6, and matching the colors through an activity called "Let's Do Our Own Lovely Train Loaded with Fruits" (P1) which was made completely of waste material. Doing a cut and paste activity, the prospective teacher contributed to their motor development (See Picture 1).



Picture 1. An image of "My Lovely Train Loaded with Fruits"

It supports the cognitive developmen domain (The child concentrates, counts the objects, observes, does matching according to color, tells the name of the geometric form). It supports language development domain (the child examines the visual materials, aswers questions related to the visual materials). It supports motor development domain (The child lays the objects together, piece them together to create new forms, stick them together, cut them). Output after the activity is such concepts as primary-secondary colors, circle-square, odd-even, front-back, up-down, in front of-at the back, bottom-top-middle, former-latter, same-different-similar.

3.2. Modelling Capability

Picture 2. A Picture of the "Soapy Water and Soapy Hand" experiment

Review of the portfolios and observation data also showed that science experiments are effective in modelling capability of children. For example, in the "Stampeding Peppercorn" experiment, it was found that the habit of washing hands with soap can be acquired (P28). In this experiment, the peppercorn as a visual element represents the microbes. If we immerse our hand with soap, we see that the peppercorn stampedes and it never likes soap.

Picture 3. A Picture of "Stampeding Peppercorn" experimen

3.3. Forming Patterns (Matching-Establishing Relationships -Raising Awareness for Movements that Require Object Control)

Review of the portfolios and observation data also showed that the experiments and maths materials raised children's awareness in terms of balancing objects of different sizes and weights on a scale. For example, sorting objects with different sizes, colors, weights and figures in an ascending order, grouping, estimation, observation, and establishing a cause and effect relationship. The "Let's Weigh the Numbers" science-maths-play activity emphasizes the importance of child's ability to perform the movements that require object

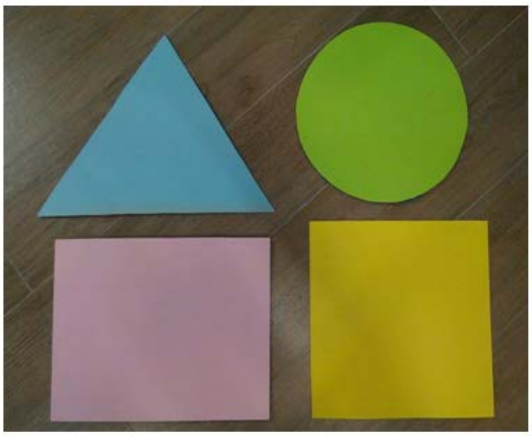
control (see Picture 4 and Picture 5). This activity also improves child's ability to form patterns and use them in daily life.

Picture 4. A Picture of experiment materials

Picture 5. A Picture of "Let's Weigh the Numbers" activity

3.4. Multipurpose Usability of a Single Material

Prospective teachers state that many experiments can be made at home/in the classroom at zero cost using a single material that can be created by using waste material. For example; a prospective student explains it like this in her portfolio (P26). *"I am a graduate of vocational high school for girls and when I heard the word experiment I always remembered such things as heater, alcohol and beaker, but When I was preparing my portfolio I found that I could teach children a lot of things by using only "cloth-paper-rope. This caused me to make a lot of plans about my career development and daily life*."



Picture 6. A Picture of experiment materials

Picture 7. A Picture from the "journey to the Seasons" activity

Another prospective student made the following remarks in her portfolio (P23). "*As can be seen from the sample experiments that I made, we do not need expensive materials and different equipment.*" The aim of the "Journey to the Seasons" material aims to teach children clothing according to weather conditions, finding solutions to problems, shapes, colors, texture, thin-thick, and etc.

3.5. Having an Impact on the Social and Emotional Progress of the Children

Based on the examination of portfolios and observation data, one can see that home/classroom experiments affect children's social-emotional development. For example; in the "What was It that I Touched" experiment (P36), "I can do it" feeling was observed in the children and this shows that home-kitchen-classroom can be used as experiment spaces (See Picture 6). Children always feel themselves ready to explore the physical environment in which they are. When they take the opportunity to explore they become interested. When they research in their daily lives, they also create a strong and permanent mental image of their experiences ([9], p.12).

Picture 8. a. "What was It That I Touched?" b. Pictures from the Experiment Stage

In the lights of the portfolio assessment and observation notes taken by the researcher, another finding is that there are some points that must be taken into account when using the home/classroom environment as experiment space. They are as follows;

- The experiment must be preplanned and materials must be ready.
- Experiments must be at student's level of development and be suitable to his/her want and readiness.
- Before the actual implementation, the experiments must definitely be tried by the teacher, necessary modifications must be made, and it must be tailored to the level of the child. It was observed that by doing this, the time is used correctly and fruitfully.
- The planned experiments must be evaluated from the child's point of view, and if necessary, they must be redesigned according to children's perceptions.
- When using the home and classroom as experiment spaces, objects of possible harm must be removed as far as possible, and ultimate care must be taken to create a suitable environment for the experiment.
- The teacher must be aware of the fact that the individual characteristics differ from one child to another and that expecting from them more than their actual abilities will demotivate them and they will get bored even with the simplest experiments.
- In order to get a good control of the experiment, it should first be implemented with a small group.

Based on the portfolio assessment and the notes taken by the researcher, the advantages of the approach of conducting experiments in the home and classroom environments were found to be as follows:

- It supports the questioning of the results of the observations and experiments.
- The experiment approach responds to teachers' and children's attempts to learn about the world in which they live.
- It increases children's curiosity.
- The child is able to define his/her environment better.
- Because children conduct the experiments themselves, this approach is effective in the development of their self-care abilities and improvement of their self-awareness abilities.
- Home/classroom experiments have some serious cost advantages.
- It was found that establishing relationships with the daily life is effective in discovering life skills, and this was especially emphasized by the prospective teachers.
- One of the most important advantages of home/classroom experiments is that one can use waste materials to conduct the experiments.
- In this way, they contribute to children's sensitivity towards the environment.
- If children carry out the experiments under the supervision of their parents, this will make children

happy and will increase their self-confidence and therefore will contribute to their motivation.

- Home/Classroom experiments offer children a lot of opportunities. In addition, children directly make their own experiences more interesting and enjoyable in their lives.

Prospective teachers' views on the portfolio implementation in the Science and Maths Course are categorized in Table 1.

Table 1. Students' views on the portfolio implementation in the Science and Maths Course

Categories / Responses	f
What did I do during this course?	
I made an article review	45
I was planned and I used the library	10
I tried to create different activities	26
I followed the science and technology	33
I practiced by trying to take notes	10
What did I learn?	
Compared to other courses, I learned more distinctive things.	
I am now able to transfer what I have learned to others	42
I've been reconciled with maths	32
When investigating experiments, I noted down the ones that I found different	4
I learned how to prepare activity plans	5
I learned how to prepare daily plans	38
I learned what to do with the materials at home	12
I learned that learning is a process	42
I learned to use scratch paper when studying	46
I discovered that things are more meaningful with children	5
Points/Activities in the study that I found I was successful	
I used the waste materials professionally	43
I knew myself	20
I developed tools at zero cost	38
My creativity and imagination improved	24
I enjoyed my activities	41
I gained self-confidence and learned the importance of group work	37
Points/Activities in the study with which I had difficulty	
I had difficulty in creating experiments	12
I had difficulty in tasks that required hand skills	18
I had difficulty in keeping up with the pace of the course and in understanding the method of the course	34
Preparing the portfolio took my time	42
Skills that I think I acquired throughout the Science and Maths course	22
This course contributed to us in terms of such skills as social sensitivity, awareness, cooperation, solidarity, effective communication, and self-assessment	27
I was patient and act according to needs	33
I learned to be open to innovation and to use the methods when and where necessary	44
My skill of criticism improved	45
I used the technology in the right place	36
I explored what I can do	12
My sense of competition improved	30
My sense of taking responsibility improved	
Occupational skills that I thing I gained from the Science and Maths course	45
I learned from this study that there are a lot of materials around me that I can use in science activities	46
By writing reports about the material, I learned how to prepare materials	31
I paid attention to doing research in all areas and courses	27
My relationship with children grew stronger although I am a second year student	31
I gained the skills of leadership and actively participated to the lessons	47
I improved my skills of preparing presentations and speaking	
My thoughts on and recommendations for portfolio assessment	41
I improved my research skills	45
I understood the importance of literature review	44
I improved myself through peer assessment	46
I saw my deficiencies through my research	12
I started to read articles in other fields	37
I improved myself with the feedback of my instructor	45
I adopted economy and saving as my life style	46
I understood what process-driven learning is	

According to the statements of the prospective students in Table 1, the portfolio implementation in the Science and Maths course supported their personal and occupational development and improved their self-

confidence. These feelings are manifested in their statements that their self-confidence are increasing consistently and that they are more aware of their achievements. The analysis, documentation and presentation of the activities that the prospective teachers conducted helped them to reflect their strengths and weaknesses in the beginning of the course, their changing interests and types of perception due to portfolio implementation, and their need for continuous improvement. Furthermore, they especially emphasized the fact that the science and maths course caused more enjoyable and more permanent learning with accompanying research and activities. However, the consensus that students reach in the form of self expression through individual or group works and discussion and critical analysis of their occupational development was found to be rather difficult and time consuming. The portfolio process encourages students about sparing more time for studying and research.

After the document review of all portfolios (N=49), observations and implementations, "A Model for Home/Classroom Experiment Approach" has been obtained that will allow for seeing all the related elements from a single point of view (see Figure 1). The aim of this model is important in that it offers a flowchart for the use of home/classroom as an experiment environment.

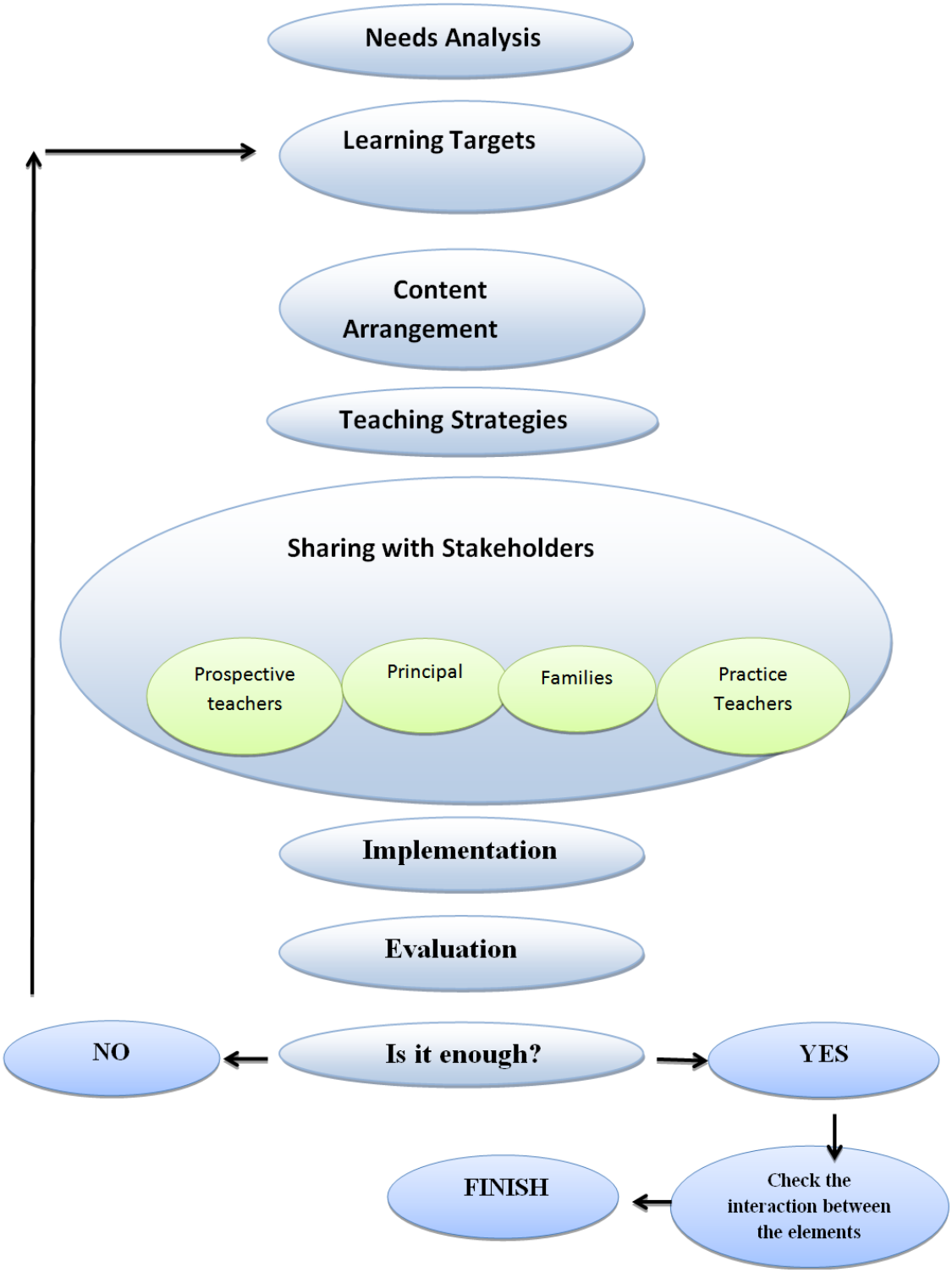


Figure 1. "A Model for Home/Classroom Experiment Approach"

At the first level of the flowchart, a needs analysis is made by taking an expert's opinion. After the learning targets have been set, the contents are created accordingly. After the creation of the contents, different teaching strategies are developed. For science experiments and maths materials, the most suitable strategies are determined as discovery and brainstorming methods. Brainstorming allows for sharing with stakeholders. At the end, an evaluation is made about whether the targeted behaviour has been gained. If the evaluation shows that it is enough, the interaction (congruence between learning targets and gains, congruence between method and implementation) between the elements is checked and so the teaching process comes to an end. If the targeted behavior is not congruent with the gains, the process starts again from the learning targets. Figure 1 shows this loop.

4. Conclusions and Recommendations

Prospective teachers can get the necessary skills that can be the foundations of their lives by making suitable plans, designing suitable experiments and materials, and by using different methods. The positive and supportive attitudes of educators and parents are important in making the children to get these skills qualitatively. Each activity that is conducted with children will enrich their small world. For this reason, prospective teachers must be good observers, must be able to canalize children to such activities whenever they need to, and must develop their skills of observation, research, investigation, experimentation and questioning by asking them open-ended questions about everthing. Observing whether or not a child can transfer the knowledge that she learned in the school or in her environment into her real life can be made only by parents and teachers. Therefore, prospective teachers must not see the science and maths education in the early childhood as an activity but as a life skill.

It is possible to create projects and conduct experiments at home/school. The findings of the study have shown that science experiments and activities made with maths materials can be used as a laboratory for science and maths education in all cases with waste materials and without structured apparatuses. Prospective teachers stated that through the portfolios that they created they reflected the individual differences, occupational values, problem solving skills in the daily life, and life styles. These findings were obtained through a study made by prospective teachers and it was found that a lot of things can be achieved if different environmets are used. All these make the present study important.

The present study shows that as the result of portfolio implementation and evaluation, the improvement of the teaching skills of the preschool teachers was observed in terms of being reflective practitioners, making progress on school-wide priorities and building professional cultures. When preschool teachers made a personal commitment to systematically collect data on their work, they were working on a process that would lead continuous growth and development. When each lesson was looked on as an empirical investigation into factors affecting teaching and learning and when reflections on the findings from each day's work inform the next day's instruction, teachers developed greater mastery of the art and science of teaching. In this way, the preschool teachers implementing portfolios were making continuous progress in developing their strengths as reflective practitioners. Moreover, energy and creativity of a group of committed preschool teachers on portfolio implementations would inevitably lead to program improvements, students' success and as well as to the school-wide priorities. When preschool teachers participated in portfolio implementations, significant progress on the school-wide priorities happened. Preschool teachers, who shared a passion about aspects of teaching and learning, conducted investigations into that area of interest and then shared what they had learned with the rest of the school community. This allowed an entire school or faculty to develop and practice the discipline that preschool teachers offered. All these contributions and affords into the field of portfolio implementations created organizational learning and built professional cultures.

When preschool teachers began engaging their colleagues in discussions of portfolio implementation and evaluation, it framed the dialogue that produces wiser professional decisions. This study has shown that preschool teachers who elected to integrate the use of portfolio implementation and evaluation into their work started exhibiting the compulsive behavior of enhancing their motivation and efficacy, checking their own pace and collecting data on their own development. By implementing and evaluating portfolios, preschool teachers had strong content background in each of the subjects they teach, became familiar with the range of student differences in their classrooms, and was capable of diagnosing and prescribing appropriate instructional modifications based upon a knowledge of each child's uniqueness. In this way, portfolio work met the needs of different student expectations. In addition, There is a standards based system in education. These standards are made by most education departments and ministries. Although they differ somewhat from state to state and province to province, specifically, they are rigorous and meaningful. Education departments and ministries expect all students to meet the standards at the mastery level. To achieve that, preschool teachers shaped their professional practice of education with portfolio implementations and evaluations to reach these high standards.

As one can see, portfolio-based learning, implementation and assessment make it possible for a student to give meaning to new knowledge by starting from her own knowledge without separating her brain from her body, feelings and social environment, and it perceives the student as a whole and aims to educate them as all-rounders. This study has shown that as an alternative assessment tool, portfolio implementation can be used successfuly in the "Science and Maths Education" course with prospective teachers in undergraduate education.

This study makes the following recommendations:

- It is thought that simple science experiments and maths activities that can be conducted at "home/school" in the preschool period will offer children rich experiences. Teachers and parents can be informed of this.
- Workshops can be organized on how to design experiments and maths materials using waste material.

- Through in-service training courses and seminars, preschool teachers and prospective teachers can be informed of waste materials and science and maths experiments.
- Science and maths course is limited in terms of course coverage. In a longer period, a pilot work may be done to find out about the effectiveness of the experiments and materials.
- In educational institutions, experiment and learning environments that are suitable for the constructivist approach can be created.
- Portfolio implementation and assessment is recommended in the teaching of different courses in teacher training departments of universities in general, and in the teaching of all courses in the departments of preschool teaching in particular.

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