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Full Length Research Paper

An appraisal of needs and access of in-service education and training for teachers in basic ‘Schools for the Deaf’ in Ghana

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Teachers like all other professionals need to undergo continuous professional development through in-service training to upgrade their skills and the competencies in the profession. This paper examined the availability of in-service training to teachers of the deaf in Ghana as well as the requirements for the provision of in-service education. To achieve this, ninety-four teachers and four administrators from the schools for the deaf from ten regions were sampled for the study. Questionnaire and interviews were used to collect data. The data were analyzed using descriptive and inferential statistics. The study revealed that in-service training programmes are highly irregular. Insufficient funds have also been identified as one of the major factors hindering the organization of in-service education. Key recommendations are that staff development should be viewed as a policy issue, as a necessity and continuous process. Thus, more resources should be devoted to staff development at regular intervals.

Key words: In-service training, professional development, needs, access, teacher, deaf.

INTRODUCTION

The training of teachers has long been recognised as a key factor in the quality improvement of educational systems and the science of developing a good teacher is the domain of professional development. The idea of one period of initial training could be sufficient for an entire career seems outmoded in the field of education (Montrieux et al., 2015). It is now increasingly recognised the world over that the education of all teachers ought not to be exclusively pre-service education. In-service training is an important component in the education

system, and plays a key role in the behaviour of society. Thus, there is widespread agreement that in-service education and training for professional development is an essential ingredient in the process of teacher professionalism to meet the pace of social and educational change.

The upgrading and progressive extension of programmes of initial teacher training have received concrete attention world-wide. In Ghana, there have been many educational reforms since independence. These

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include the New Structure and Content of Education of 1974, the Free Compulsory Universal Basic Education (FCUBE) of 1987 and the Educational Reform Review Committee of 2004 (Adu-Gyamfi et al., 2016). The FCUBE aims at providing quality education for all pupils, increase access to and making education affordable to all children of school going age and changing the curriculum to meet the needs of the people and the nation. To achieve this, it is necessary to restructure the existing programmes as well as making provisions to up-grade teachers in the service through in-service training.

A primary concern of in-service training is the provision of its requirements and of its accessibility to the target professionals on regular basis. There are no clear cut policies as to how, and at what interval in-service training should be provided. This has led to lack of well-defined programmes for upgrading teachers. Such situations leave teachers for decades in class to contend with moment-to-moment classroom challenges with only the initial training received at college (Humphrey, 2014). Such has often been the case in many special schools in Ghana, resulting in a trend where teachers are generally not conversant with educational changes and innovations. Indeed, the structure of special education administration in Ghana is itself quite problematic. While the director of special education is in charge at the districts and schools levels, teachers are answerable to district and regional directors, resulting in a trend where Special Education Division has minimum control of the nature of in-service programmes organised on district and regional levels (Lawrence and Anastasiou, 2015). The inappropriateness of the externally designed in-service training activities has been extensively commented and written about. Though avenue for teacher education through in-service exist; the prevailing in-service training programmes however, are not effective as they are externally designed without the involvement of the teacher (Malcolm, 2006). They are also presented in a didactic manner which does not help teachers to deal with actual classroom situation. Thus, In-service training activities, designed for the special educators have become even more critical to teachers of the deaf so that they will continue to provide good education for deaf children.

Statement of the problem

Trends in education are changing; teaching itself is complex and requires constant learning and continual reflection, and so there is the need for teachers at all levels not only to update their skills and knowledge, but also to totally transform their roles as educators and establish new expectation for pupils and schools. Teachers, like all other professionals, need to undergo a Continuing Professional Development (CPD)

programmes in order to keep abreast with trends in the profession. Even though CPD can be achieved through reading and short courses in the area, the traditional way in which teachers receive CPD is through in-service training which in most cases in the Ghana Education Service does not exist. Lack of access to further development for any staff has its negative effects, but in-service activities are highly irregular for teachers of the deaf in Ghana.

Teaching and learning needs of the deaf

Teaching and learning needs of the deaf require an urgent prerequisite for centralized information dissemination. Recent evidence suggests that this will provide a wide range of resources for professionals and parents responsible for the education of deaf students in science, technology, engineering, and mathematics (Wenglinsky, 2005). Previous studies (Iva and Ronnie, 2016) have reported the development of new technologies to effect positive change in the education of students who are deaf to acquire knowledge. Knowledge has the most important characteristic of an effective teacher (Khojastehmehr and Takrimi, 2009), but some research (Marschark et al., 2015) has shown that the academic achievement of deaf students may be influenced by their teachers' knowledge of the content. Thus, the effects of being taught by a teacher without a strong background in a field may be just the kind of outcome not captured in student scores on standardized examinations (UNESCO, 2015).

Teacher Education (preparation)

Teacher preparation is a program of professional course work that develops the required skills for serving in the classroom and will lead to certification. This includes course work in areas such as teaching methodologies, curriculum development, classroom management, and student or intern teaching fieldwork (www.ctc.ca.gov, www.teachcalifornia.org, retrieved May29, 2018). But effective teacher preparation should go beyond knowing subject matter, pedagogic and child development; it should include research by teachers (Darling-Hammond, 2000). One of the best ways for teacher education program to become and remain effective is to evaluate its current status, on an ongoing basis (Frank et al., 2014). However, an effective educational program should encompass special education needs elements in all courses of initial teacher training (Carroll et al., 2003). The training of competent teachers is considered to be the most persistent and compelling need in education since no system of education can rise above the quality of its teachers. In other words, the quality of teachers in terms

of their training and awareness will determine the quality of instructions and invariably the success of the programme (Oyewumi and Adediran, 2001). Well-trained staff is essential for achieving the educational goals, while poorly trained staff impede progress (UNESCO, 2015).

Concept and meaning of in-service education and training

The terms in-service training and professional development are often used interchangeably, but have slightly different meanings. According to the Organization for Economic Cooperation and Development (OECD) (2000), professional development signifies any activity that develops an individual's skills, knowledge, expertise and other characteristics as a teacher. These include personal study and reflection as well as formal courses. In-service education and training refers more specifically to identifiable learning activities in which practicing teachers participate. Like all members of professions, teachers need to be involved in a process of learning and reflection to improve their professional practice (Aitken: 2000). In-service training may broadly be categorized into five different types whose meaning depends on the key word: (1) induction or orientation training, (2) foundation training, (3) on-the-job training, (4) refresher or maintenance training, and (5) career development training (Armstrong, 2006). All of these types of training are needed for the proper development of extension staff throughout their service life.

In-service training/ workshops for teachers of the deaf

The significance of in-service education and training for special educators has to be seen in the context of relative scarcity of special education needs elements in initial teacher training (Golder et al., 2005).

'The educators and other staff responsible for making decisions regarding the educational needs of students with hearing loss have limited training or experience in serving students with a hearing loss. In service thus becomes critical to educators and staff.' (pp. 52-58).

Staff training becoming necessary is circumstance where there is evidence of lack of appropriate training and requisite experience (Avoke, 2002), but such training relating to special needs is scanty (Upton, 1991); it is an ignored topic both in general literature and research (Avoke and Yepkle, 2004). Specialist staff training is exceptional topic in journals and rarely forms the basis of

research and constitutes the contents of very few books (Timperley et al., 2007). Following the Japanese International Cooperation Agency (JICA) and the Ghana Education Service (GES) collaboration of a framework for in-service training policy for basic education teachers, in-service activities at the school and district levels had increased in Ghana in the last few years. The training, however, does not reflect any measurable change in the work output, especially in instructional practices at the classroom level (GES, 2007). Although the aim was to establish an institutionalized structure for basic school teachers' continuous professional development (CPD), there was no opportunity created for special teachers in the service.

Objectives of the study

The current research (i) examines the extent to which teachers of the deaf have access to in-service training (ii) explores the types of in-service activities provided for teachers of the deaf and (iii) elaborates on the types of in-service activities needed for teachers of the deaf.

METHODS AND PROCEDURES

The following methods and procedures were considered to arrive at the data, analysis, interpretation and discussion. The target population, sampling and sampling technique, research instruments, data collection procedure and analysis plan have been outlined.

Target population

The target population for the study included all two hundred and ninety three teachers from thirteen schools (13) for the deaf in Ghana. The breakdown of the target population is shown in Table 1.

Sampling and sampling technique

Ninety-four respondents who were selected by simple random sampling were involved in the study. They comprised three District Directors of Education, ninety teachers of the deaf and one personnel of Special Education Directorate representing about thirty percent of the total population. Respondents were made up of 43 males and 51 females.

Sampling technique

Hallberg (2013) emphasized that the quality of a population sample affects the quality of the research generalizations. Simple random sampling technique was employed to sample 94 teachers of the deaf and administrators to ensure that there was no researcher bias in selecting the respondents. Obtaining an unbiased sample is the main criterion when evaluating the adequacy of a sample (Hallberg, 2013). Purposeful sampling was employed for the three education administrators since these were people in charge and responsible for In-Service Training within their Districts or Ministry and so it was appropriate to seek their views and opinions. The Officer from the

Table 1. The breakdown of the target population.

Category	Participants	Male	Female	Total
Administrators	4	2	2	4
Teachers	90	41	49	90
Total	94	43	51	94

Special Education Directorate was purposely sampled as he was the only one in charge of training at the special education Directorate.

Research instruments

Likert-type questionnaires were used to collect data on the needs and access of In-Service Education and Training for teachers in Basic 'Schools for the Deaf'. The questionnaire was used since the study was mainly concerned with variables that could not be directly observed or manipulated. The confidentiality of the study was also taken care of by the questionnaire. Ninety four questionnaires and interview guide were the main instruments used to collect data for the study. Questionnaire items were in four sections: Section A contained four items that sought to gather information concerning respondents' background. Section B had five items seeking to gather data on the availability of in-service programmes to teachers of the deaf. Section C was made up of six items that sought to find out the type of in-service programmes provided for teachers. The last part, section D, was to sample the views of teachers on how in-service should be organised, and these consisted of seventeen items. The questionnaire was crafted into Likert scale of five responses, categorised as: Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree.

Interview guide was also designed to engage the rest of the respondents in some sort of dialogue so that they would be able to express themselves beyond Yes or No responses. The interviews were used as a means of triangulation. Schedules for the interview were devised comprising semi-structured items. By the semi-structured method, only broad and misunderstood areas were identified and probing questions asked on them (Lynas, 2001). The interview was recorded using a Philips Dynamax2 hi-fi recorder so as to note the opinion, attitude, preferences and perception of persons of interest to the study.

Data collection procedure

Interview sessions

Interviews were conducted on one-on-one basis for three District Directors/training officers and the one personnel of the Special Education. Each session lasted about 20 to 30 min. Prior consent to be interviewed and audio recorded was sought from respondents and the purpose of the research explained to them. Hancock et al. (2007) stated that tape recorders allow the researcher to engage in lengthy informal and semi-structured interview capturing verbatim quotations in a natural conversational flow.

Administering the questionnaire

Copies of the questionnaire were administered and retrieved by the researcher within a period of one week and this was done to avoid

the phenomenon of late response by the respondents (Robson, 2002). Of all the ninety-six copies of questionnaires administered there was about ninety-eight percent (98%) recovery rate.

Data analysis plan

A combined methodology approach was adopted in the analysis of data collected. Descriptive statistics were employed to answer research questions. Responses to questionnaire were categorised according to how they related to the research questions and analysed into frequency tables using MS excel. Interviews were transcribed and analysed based on emerging themes while verbatim expressions of respondents were noted at the appropriate sections.

Validity of the research

The validity of the research was established with a pilot study. The data collection instruments were pilot tested on 10% of sample size to discover possible weakness, inadequacies, ambiguities and problems in the instrument, at the Sekondi School for the Deaf in the Western Region of Ghana. A non-probability method - convenience, was adopted for the pilot study. The data collection instruments and the sample size were considered appropriate since they had the same characteristics with study schools and sample population.

RESULTS AND DISCUSSION

In response to the purpose for which this research was carried out, the data collected from respondents were processed into frequency and percentage tables as shown in Tables 2 to 4. Majority of the respondents were between the ages of 31-40 years. Sixty four percent of these were untrained and had been teaching for less than six years. The results together with the discussions were carried out in response to the research questions: to what extent do teachers of the deaf have access to in-service training, what types of in-service programmes are provided for teachers of the deaf and what types of in-service activities are desirable for teachers of the deaf.

Teachers access to in-service training

Results in Table 2 illustrate teachers' responses regarding the extent to which teachers of the deaf have access to in-service education and training. About

Table 2. The extent to which teachers of the deaf have access to in-service education.

Statement	Agreed		Neutral		Disagreed		Total	
	freq	Rf(%)	Freq	Rf	Freq	Rf(%)	N	Rf(%)
1. INSET/workshops for teacher of the deaf are organized regularly in my school	30	31.9	5	5.3	59	62.7	94	100
2. INSET/ workshops for teacher of the deaf are organized regularly in my circuit	6	6.4	4	4.3	84	89.4	94	100
3. INSET/workshops for teacher of the deaf are organized regularly in my region	6	6.4	4	4.3	84	89.4	94	100
4. I have had the opportunity to attend in-service training/workshops	30	31.9	4	4.3	60	63.9	94	100
5. My school policy encourages the attendance of in-service/workshop	47	50	8	8.5	39	41.5	94	100

freq stands for frequency; N is the sample size.

Table 3. Types of in-service programmes provided for teachers of the deaf?.

Statement	Agree f (%)	Neutral f (%)	Disagree f (%)	Total F (%)
6. INSET/workshops I attended covered current practice of teaching deaf children. (N = 94)	22 (5.3%)	5 (5.3%)	67 (71.2%)	94(100%)
7. INSET/ workshops I attended covered some subjects I had difficulty with. (N = 94)	15 (16.0%)	5 (5.3%)	74 (79.0%)	94 (100%)
8. INSET/workshops I attended covered identification of other disabilities. (N = 94)	14 (14.9%)	7 (7.4%)	73 (77.6%)	94 (100%)
9. INSET/workshops I attended covered new methodology. (N = 94)	13 (13.8%)	8 (8.5%)	73 (77.6%)	94 (100%)
10. INSET/workshops I attended covered the preparation and usage of teaching and learning materials. (N = 94)	18 (19.1%)	6 (6.4%)	70 (74.4%)	94 (100%)

f stands for frequency; N is the sample size.

Table 4. Types of INSET programmes teachers needs and how it should be organized.

Statement	Agree f (%)	Neutral f (%)	Disagree f (%)	Total f (%)
11. INSET for teachers of the deaf should cover identification of student with other disabilities (N = 94)	85 (90.4%)	2 (2.1%)	7 (7.5%)	94 (100%)
12. INSET for teachers of the deaf should deal with how to support learning needs of the deaf (N = 94)	93 (98.9%)	-	1 (1.1%)	94 (100%)
13. INSET for teachers of the deaf should cover subjects I have difficulty with (N = 94)	93 (98.9%)	-	1 (1.1%)	94 (100%)
14. INSET for teachers of the deaf should cover use of technology in teaching the deaf(N = 94)	93 (98.9%)	-	1 (1.1%)	94 (100%)
15. INSET for teachers of the deaf should cover the preparation and usage of teaching and learning materials (N = 94)	92 (97.8%)	1 (1.1%)	1 (1.1%)	94 (100%)

f stands for frequency; N is the sample size.

62.7% respondents disagreed with the statement that in-service training was organized regularly in their schools, while 30 respondents, that is 31.9% agreed with the statement. Eighty four respondents, representing 89.4% said in-service training for teachers of the deaf was not regularly organized in their circuits and regions while 6 or 6.4% said it was organized. Whereas 31.9% of respondents had the opportunity to attend in-service training, 63.9% never had such opportunity (Table 2). Exactly (50%) of the respondents agreed that their school policy encouraged the attendance of in-service training, thirty-nine respondents representing 41.5% disagreed and 8.5% were unsure.

Generally, the analysis indicates that in-service training programmes were not uniformly available to teachers of the deaf but minority have opportunity. The absence of these training activities meant teachers would not have the opportunity to equip themselves with new skills required for coping with emerging trends and demands of teaching. Access to in-service education and training are highly irregular and inaccessible to teachers of the deaf. Teachers of the deaf have to contend with their day-to-day classroom challenges relying on the initial training they had. This situation however, does not ensure good education for deaf pupils. The best of pre-service teacher education cannot equip one for lifelong standing (UNESCO, 2018); it is inconceivable to assume it was adequate. Continuous growth and development is necessary for teachers especially in the light of an expanded knowledge base and continuing nature of changes that is occurring in society; the need for continuous professional growth among teachers takes on a critical new importance. All four personnel interviewed agreed that in-service education and training was irregular. It was quite revealing that two of the officers who had oversight responsibility for training did not themselves have any clue on what policy existed in that regard based on the following statement:

"In fact, I am not aware of anything that has to do with in-service training in this District, even though I have been hearing that some form of in-service training are being organized by certain agencies for teachers in the Districts; the truth is I have no idea regarding policy on in-service"(Verbatim comments from a District Education officer).

The Wa Municipal Director even though was not aware of what the policy was regarding in-service training had an established programme for in-service training sponsored by Japanese International Cooperation Agency (JICA) for capacity building of staff and teachers of the municipality. Interestingly, all provisions were for all basic schools in the municipality. Special teachers required special training, and their training was considered expensive.

The director explained:

"As for special teachers, there is nothing like in-service education and training for them because sponsors do not want them to be part because their needs are different and expensive".

Other issues affecting the inaccessibility of in-service education and training that emerged during the interview session was traced to the organizers. The training officer at the headquarters mentioned that organizers do not invite teachers from special schools because the officer believes special educators are perceived as being in charge of children with disabilities and not the education of children with disabilities. The findings of the study indicated that teachers in schools for the deaf did not attend in-service training activities. Consequently, some are unlikely to be abreast with innovative teaching strategies of educating the deaf. Every educational system should change with the culture, economic and technology to keep abreast with the changing demands of the time. Effective change will only occur in the classroom if teachers are involved through the process of in-service training. In-service training is designed to equip teachers with new skills required for coping with emerging trends and demands of teaching.

The unavailability of in-service programmes to teachers of the deaf as indicated by the findings of this study is in line with the one conducted by the ADB (2017). The study which was conducted on teachers of agriculture in Kwara State of Nigeria indicates that respondents (teachers) had not had the opportunity to receive any form of in-service training for five years. Society now demands more from its schools and teachers in the area of exposure and technology (Hargreaves, 2003) but this cannot be achieved with the irregular nature of in-service training for teachers of the deaf as is the case of these findings. For teachers to stay ahead, in-service training must take place on a regular basis, so that teachers are "reflective practitioners" in their classrooms and schools become "learning organizations" (Hargreaves, 2003). Samar (2014) also recommends that continuous training programmes are important for keeping the teacher abreast with rapidly developing technologies and methodologies advances in the field. The minimum qualification in the teaching profession was certificate 'A' and 46.9% of the teachers were below this grade and nonprofessional. In most cases, educators and other staff responsible for making decisions regarding the educational needs of students with hearing loss have limited training in serving students with a hearing loss and so the significance of in-service education and training for special educators has to be seen in the context of relative scarcity of special education needs elements in initial teacher training (Golder et al., 2005).

Type of in-service training provided for special teachers

The training and facilitation of the special child is as important as the type of in-service training provided for the special education teacher. The current practice of teaching the deaf, the preparation and usage of teaching and learning materials as well as new methodologies depends on the type of training offered to the teacher. Responses from the sampled population are presented in Table3.

From Table3, sixty-seven respondents representing 71.2% disagreed that workshop they attended covered current practice of teaching deaf children while 24.5% of the respondent agreed it did cover. Whereas 16% of the respondents agreed that the few in-service training they attended covered some difficult subjects, seventy-four respondents representing 79% disagreed. Seventy-three representing (77.6%) of the respondents disagreed while fourteen which is 14.9% of the respondents agreed with the statement that the workshop they attended covered identification of other disabilities in deaf children. While seventy-three respondents representing 77.6% disagreed with the statement, 13.8% of the respondents agreed with the statement that workshop they attended covered new methodologies. With 74.4% of the respondents disagreeing that workshop they attended covered the preparation and usage of teaching and learning materials, 19.1% of the respondents agreed it did. On the whole, the above presentation gives the impression to presuppose that in-service education and training did not address the needs of teachers of the deaf. In an interview with a training officer at the Special Education Headquarters, it was discovered that little was being done to provide in-service education and training to teachers of basic schools for the deaf. He commented as follows:

Sign language is not the only problem; in fact the difficulties are numerous, like the preparation and usage of teaching and learning material, new teaching methodologies and even subject content (Verbatim Expression of Training Officer, Headquarters).

One of the Municipal Directors of Education noted that in-service training of teachers was largely centralized and that was accounting in part for the lack of opportunities for teachers in special schools, since many at the policy level were not aware of the support required for special teachers. He said, "There are difficulties in organizing in-service training, and so we cannot design activities to suit special teachers, everything has been centralized".

Findings of the study indicated that in-service training programmes did not cover identified important areas like current practices in the teaching and learning of the deaf,

some difficult subject matter and others. These are very important if deaf children are to get good education. When in-service training programmes do not cover present needs, then it means that teachers are not exposed to innovative teaching strategies. This obviously is not in congruent with the theory of change which states that teachers should be given regular training to enable teachers face changing demands of school and society. Ahmed (2015) in this same view argued that the changing conceptualization of special education has highlighted a need to look seriously at the pattern of training which currently exists and the way in which we attempt to deliver training.

The revealed situation is not in line with provisions stated in the policies and strategic plan for education. According to MOE (2000), Policies and Strategic Plans for Education Sector, non-residential courses are usually organized for teachers, college tutors and field officers by specially trained subject specialists at the regional or district offices. A teacher's understanding of subject matter is very important. Ball (2000) states that teachers need to know their subject matter in depth. Understanding how to teach the subject matter in a variety of ways is the most important skill for an educator. From the analysis and discussion it has been established that the type of in-service training activities provided do not meet the in-service needs of the teachers of the deaf.

Type of in-service activities needed for teachers of the deaf

Eighty-five respondents or 90.4% of the respondents agreed with the statement that in-service for teachers of the deaf should cover the identification of other disabilities. On the other hand, 7.5% of the respondents did not think that was necessary. Majority believed the identification of other disabilities in deaf pupils was necessary in adopting appropriate methods that suit them. Ninety-three respondents representing 98.9% agreed with the statement that in-service/ workshop should deal with how to support learning needs of the deaf while one respondent or 1.1% of the respondents disagreed with the statement. An overwhelming response indicates that teachers of the deaf had some needs in terms of handling deaf children. About 98.9% of the respondents agreed with the statement that in-service training should cover some subject teachers that had difficulty teaching the deaf, while one or 1.1% of the respondents disagreed with the statement. For instance, mathematics was noted by Ray (2001) as one of the challenges the hearing-impaired children encounter during learning.

Mayberry (2002) argues that in order for hard to hear children to develop cognitively, particularly in a mathematical sense, in-service education and training

should cover a wide range of meaningful mathematical experiences that are visually engaging and hands-on for the teachers. Activities should be purposeful and have relevance to everyday life so that they can be experienced in a context other than a purely mathematical one. The issue of some subjects being difficult to teach in special schools has also been identified in an evaluation on a large-scale reform in Canada in which special educators express similar concerns as reported by Fullan (2000). He indicated that almost two-thirds (63%) of the teacher respondents claimed that some subjects were more demanding or difficult than others and will need more attention on how to handle them.

Ninety-three respondents representing 99% agreed with the statement that in-service training/workshops should cover the use of technology in teaching the deaf. Only one 1% of the respondents disagreed with the statement. This is an indication that special schools need to integrate technology in the teaching of deaf pupils. This integration requires that teachers are able to use technology effectively in whatever subject they teach. Thus, this requires professional development for teachers to master technology and learn new methods of incorporating it. From the findings, the current system does not support teachers of the deaf in acquiring these skills, and so has left many teachers with little or no experience with technology. In a study which set out to determine reasons for not using technology in teaching in Canada, Ryan and Joong (2005) said 43% of teachers attributed the phenomenon to lack of time, lack of access to computers, limited resources, and a scarcity of in-service training.

Ninety-two or 97.8% of the respondents stated that there was the need for workshops to cover the preparation and usage of teaching and learning materials. No teacher should leave the training centre without a set of self-produced materials during his/her training. The needs of the teacher go beyond just sign language. There are other issues affecting teaching and learning. Strengthening the teachers' subject knowledge base is very important and has been argued by some researchers to be critical to students' achievements. For instance, America Educational research Association (Resnick, 2005) suggests that professional development can influence teachers' classroom practice significantly and leads to improved students' achievements when it focuses on strengthening teachers' knowledge of specific subject matter content.

Organization of in-service training

As to how in-service training should be organized to benefit teachers, the findings from the interview sessions revealed that respondents will prefer programmes organized at the school level to the circuit and regional

levels. Interview results established that some form of in-service training goes on in the various schools. All four officers interviewed indicated that some form of school based in-service training had been going on in the various schools for the deaf.

While the choice of duration for in-service training for teachers of the deaf is preferably five days in Ghana, a week long in-service outside school premises is preferred by teachers in Nigeria. The type of in-service activities needed by teachers of the deaf included: new methods of teaching, identification of other disabilities in deaf pupils, teaching, preparation and usage of teaching and learning materials. Interview findings also established that teachers will prefer a five days school based demonstration workshops.

Conclusion

Teachers of the deaf do not have regular access to in-service education and training. In-service education programmes are needed to increase knowledge and skills of teachers of schools for the deaf in dealing with the teaching and learning needs of deaf students. The few available in-service training programmes are organized without the inclusion of special education teachers. This leads to situations where in-service training does not address the needs of teachers of the deaf. Lack of funds is a major factor inhibiting the regular organization of in-service training programmes as well as the training, evaluation and monitoring of the activities of the schools for the deaf.

Teachers for basic schools for the deaf have needs in computer technology, mathematical skills, general contemporary skills and practices in lesson delivery and teaching and learning materials. Teachers for basic schools for the deaf also need regular workshops to strengthen their subject knowledge base. The lack of in-service training for teachers for basic schools for the deaf however, has limited the acquisition of these requirements.

RECOMMENDATIONS

The following recommendations are made to make the organization of in-service education and training more effective and to bring about maximum benefit to teachers of the school for the deaf in Ghana. The factors militating against the effective organization of in-service training educational programmes and their undercurrent effect on staff development in basic schools for the deaf in Ghana as outlined and discussed are basically financial and organizational.

- 1). The Ghana Education Service in recommendation to

the Ministry of Education should make staff development an on-going process and a policy issue. This will make it possible for time and resources to be devoted to staff development through long term financial planning.

2). The regional and district directorates in collaboration with Non-Governmental Organizations such as the Catholic Relief Service should take advantage of the Quality Improvement in Basic Schools (QUIPS) programmes to strengthen the capacity of teachers of schools for the deaf.

3). Special educators should be involved in the designing and implementation of in-service programmes to ensure special schools benefit from the type of activities designed so that they can always be abreast with changing trends in the field.

4). Heads of special schools should do “needs assessment” within the school and invest part of the five percent allocation of the District Assembly Common Fund to special schools in the districts in staff development programmes. The success of the free compulsory Universal Basic education depends on a well-developed staff.

5). Heads of special schools should design programmes that will address the peculiar needs of teachers of the deaf after a through needs assessment as short time measures of dealing with classroom challenges on continuous bases. Professionals and specialist from the Special Education could be called on to design activities to address identified needs.

6). All providers of in-service training (including schools) are required to define in their strategic and annual plans the expected outcomes of the training to be provided and to identify the criteria they will use to evaluate the extent to which these outcomes have been met by teachers of schools for the deaf.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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Full Length Research Paper

Investigation of prospective Math teachers' perceptions about the use of technology in mathematics teaching

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This study aims to examine whether there are significant differences in the perception of prospective Mathematics teachers about the use of technology in teaching mathematics based on their gender and grade level. The study group is consisted of 271 prospective elementary mathematics teachers studying at Balıkesir University and selected by means of a simple random sampling method. Data were gathered using the perception scale developed by Öksüz, Ak and Uça (2009). A qualified descriptive scan model that aims at revealing the existing state in the research as it should be was adopted. Based on grade level, there was a significant difference in the perception of the prospective Mathematics teachers in the use of technology in teaching mathematics. According to the gender variable, it was determined that the technological perceptions of the prospective teachers did not change. There was a significant difference in disadvantage dimension, while there was no difference in terms of gender in the sub-dimensions of necessity and advantage. Significant differences were also observed between the grade levels in terms of the determined headings.

Key words: Mathematics teaching, prospective teacher, teacher training, teaching technologies, technology integration, technology use perception.

INTRODUCTION

Raising the competency of the teaching profession is possible if firstly the general and special field competencies that teachers should have are known and if teaching competencies are acquired with pre-service and in-service training curriculums of prospective teachers and teachers respectively. The dynamic structure of education and training in all its dimensions makes it essential for teachers to be qualified and undergo constant development. For this reason, the Ministry of National Education has continued its studies on teacher

qualifications by collaborating with universities (General Competencies for Teaching Profession, 2017).

Teacher competency is defined as "the knowledge, skills and attitudes that teachers have to possess in order to be able to fulfill the teaching profession effectively and efficiently". The scope of this qualification includes: teaching curriculums and subject area, ways to teach the curriculum, relation of the field with other fields, the latest developments in the area, basic concepts, means and structures of the field and having knowledge about the

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integration of the content taught with technology (Ministry of Nation Education-MNE, 2008).

Social, economic and technological developments and new approaches in education are changing the traditional roles and functions of teachers (Teacher Competencies, 2009). The raising of individuals who can use technology in schools depends on the ability of teachers to use technology effectively in teaching activities (Yanpar-Yelken et al., 2013). At this point, Mishra and Koehler (2006) present the framework of Technological Pedagogical Content Knowledge (TPCK) as a theoretical background. The framework of TPCK includes the 3 types of knowledge that teachers and prospective teachers have to possess (technological knowledge, pedagogical knowledge and content knowledge) and the knowledge types (technological pedagogical knowledge, pedagogical content knowledge and technological content knowledge) derived from intersection of these. Koehler et al., (2007) described this definition as "dynamic, interactive relationship between field, pedagogy and technology". Similarly, studies on teaching profession standards are in constant development and conversion. The "teaching qualifications" defined by the behavioral approach of the 1960s presents a conversion towards the perspective of TPCK. Research revealed that teacher qualifications significantly affect students' achievement (Darling-Hammond, 2000; Rockoff, 2003; Goe and Stickler, 2008; Teacher Competencies, 2009).

The National Council of Teachers of Mathematics (NCTM) emphasizes the importance of using digital technologies in mathematics teaching and practice as part of the technology policy. According to technology principle, mathematics learning is deepening with technology, it is contributing to teaching of mathematics subjects effectively and quality of mathematics teaching is increasing (NCTM, 2000). Association of Mathematics Teacher Educators (AMTE) indicates that teacher education curriculum should provide opportunities for teachers to acquire the knowledge and experience necessary to put technology into teaching and learning content of mathematics (AMTE, 2006).

Mathematical competence, basic competence in science/technology and digital competence in Mathematics Course Teaching Program draw attention to perception of developing technology today. In the curriculum, it is also aimed to develop basic skills in problem solving, mathematical process skills (communication, reasoning, mathematical modeling, correlation), affective skills, psychomotor skills and information and communication technologies skills (Mathematics Course Teaching Programs, 2018).

The FATİH (Movement of Enhancing Opportunities and Improving Technology) Project, designed for each student to achieve the best possible education, achieve the highest quality educational content, and ensure equal opportunities in education is the largest and most

comprehensive education action in the world on the use of technology in education. The FATİH Project has started to ensure equal opportunities in education and as an information technology tool, it addresses more sensitive organs in learning- teaching processes to improve the technologies in our schools and for effective use in lessons. With this system, classroom management will be used to provide a blackboard- tablet interaction with teacher-student interaction; information acquisition / learning processes will be used more effectively, teachers will be able to share learning materials produced in class and send homework with classroom management, and the learning levels of students can be measured and more controlled. With the FATİH Project in Education, the student can access the lecture notes, in-class projects and home works that given by the teacher as independent from the environment in which he / she is, and to share his / her knowledge with the teacher and other friends and also can reinforce the subject that he / she has learned with auxiliary documents (Movement of Enhancing Opportunities and Improving Technology-FATİH Project, 2016).

It is emphasized that the computer-use-skills of prospective teachers are important in terms of effectiveness and productivity of education process (Altun, 2003; Seferoğlu, 2004). Tekinarslan (2008) emphasizes that it is important to have prospective teachers with sufficient knowledge and skills in the field of computer technology and information literacy, including self- developed teachers and those that can direct and train their students when they become teachers. This situation is very important in terms of the institutions that educate teachers (Flowers and Algozzine, 2000; Tekinarslan, 2008). With the widespread use of technology in the education process, the educational curriculums of faculties of education that educate teachers changed and the number and hours of computer and instructional technology lessons increased. However, the vast majority of academicians and researchers agree that technology should be used as a tool rather than an educational goal (Strudler and Wetzel, 1999; Usta and Korkmaz, 2010).

When a teacher chooses a computer software, he/she should pay attention to whether the software is easy to use, especially by children, whether it teaches the information step by step, whether the exercises vary or not, whether it is interactive, and whether the feedbacks are favorable and appropriate (Sığırmaç et al., 2007). Yılmaz et al. (2015) found that the prospective teachers evaluate their computer skills as moderate and that their perceptions about the use of technology in education were sufficient. It has been determined that the majority of prospective teachers who have high computer skills also have high technological perception averages.

Saygıner (2016) found that there was not significant difference between the scores of the prospective

teachers' perception of technology use in education, depending on the gender variable. In Şendurur et al. (2012) studies, the attitudes and interest of students towards technology are very high and their resistance towards technology is very low. It also emerged that the perception of technology differs in terms of gender variable. In the study of Şad and Nağacı (2015), there was a significant difference in the perception of competence of information and communication technologies in terms of variables of educated program and having computer, but no significant differences were found in terms of gender and internet use frequency.

In today's education system, it is emphasized that teachers should be able to integrate technology to teaching. This development and spread of technology in daily life has necessitated diversity and innovations in learning and teaching methods. For this reason, in today's education, teachers have to improve themselves well in the use of technological tools in order to obtain the necessary competences needed in their profession. The studies of recent years generally emphasize teacher's technological pedagogical content knowledge. It is expected that today's teachers should be well informed about curriculum, how the curriculum will be taught and relation of the field with other fields, latest developments in the field, basic concepts, means and structures of the field and integration of the content that will be taught with technology.

In addition, the mathematics lesson draft curriculum supports the use of information and communication technologies in mathematics learning and teaching. While students are making sense of the concepts, the students benefit from information and communication technologies as they help them discover relationships between these concepts. It was emphasized that these technologies help students to develop different approaches, reasoning, and make mathematical generalizations when solving problems (Mathematics Course Teaching Programs, 2018).

Studies show that teachers' decisions, experiences, approaches, beliefs and attitudes affect the use of technology in teaching (Andris, 1995; Çağıltay et al., 2001; MacArthur and Malouf, 1991; Marcinkiewicz, 1993; Yaghi, 1996). In this context, determining the perceptions of prospective teachers who will train future generations about integration of technology into curriculum will strengthen bachelor education programs to support technological pedagogical content knowledge. As a matter of fact, it is observed that the updated mathematics bachelor programs are supported with courses such as open and distance learning, media literacy, computer aided mathematics teaching and within the scope of compulsory courses such as information technologies, algorithm and programming as well as within the context of optional courses such as general knowledge, profession knowledge and field education. It

is inevitable to investigate how the perceptions of prospective teachers are affected by the increasing importance of teaching technologies. With this aim, the technology use perceptions of prospective mathematics teachers in mathematics teaching are investigated with sub-dimensions of the scale and determined headings to know whether there is a significant difference in terms of grade level and gender.

Research questions

- 1) How significant is the difference in perceptions of prospective teachers in different genders on use of technology in mathematics teaching?
- 2) How significant is the difference in perceptions of prospective teachers in different grade levels on use of technology in mathematics teaching?
- 3) How significant is the difference in perceptions of prospective teachers in different grade levels on general contributions of the use of technology in mathematics teaching?
- 4) How significant is the difference in perceptions of prospective teachers in different grade levels on contributions to teacher of the use of technology in mathematics teaching?
- 5) How significant is the difference in perceptions of prospective teachers in different grade levels on contributions to students of the use of technology in mathematics teaching?
- 6) How is the prospective teachers' perception related to necessity of the technology used in mathematics teaching?
- 7) How is the prospective teachers' perception related to necessity of the software used in mathematics teaching?
- 8) How significant is the difference in perceptions of prospective teachers in different grade levels of the use of technology in mathematics education program?
- 9) How significant is the difference in perceptions of prospective teachers in different actions to be taken for the realization of technology use in mathematics teaching effectively?

METHODOLOGY

The model of the study

In the research, descriptive survey model from quantitative research methods was used. This model is intended to describe the views and characteristics of large masses that allow the collection, description and presentation of numeric values related to past or present conditions or variable (Büyükoztürk, 2006; Karasar, 1995; Wellington, 2006).

Study group

In the study, simple random sampling method was used. In a simple

Table 1. Frequency and percentage values of prospective teachers based on gender.

Gender	f	%
Female	209	77.1
Male	62	22.9
Total	271	100

random sample, every element that form the universe has equal chance of getting into the sample. Therefore, the significance to be given to each element in calculations is the same (Arıkan, 2004).

The study group is formed from 271 (209 female, 62 male) prospective elementary mathematics teachers studying at Faculty of Necatibey Education in Balıkesir University in 2017-2018 academic year. 23.6% of the prospective teachers participating in the study are first grade, 31.4% of them are second grade, 24.7% of them are third grade and 20.3% of them are fourth grade. In this study, 86% of the 314 (242 females and 72 males) students doing the bachelor program were reached. This rate was also reflected as 86% in the participation rates of male and female students.

Data collection and analysis process

In the study, data were gathered using the perception scale related to the use of technology in elementary education mathematics lessons by the prospective teachers developed by Öksüz et al. (2009). The scale consists of totally 73 items that includes 63 positive and 10 negative items and exhibits a three factor structure. The scale involves three factors explaining 49.70% of the total variance. The overall Cronbach-alpha coefficient of the scale was high ($\alpha = 0.96$) indicating that it was a fairly consistent measure. Cronbach-alpha coefficients for sub-scales were found as 0.95, 0.96 and 0.84. The results of the study indicate that the scale named as a perception scale for technology use in the teaching of elementary mathematics (OSTU) has good psychometric properties and is reliable and valid (Öksüz et al., 2009)

The factors are necessity, advantage and disadvantage. Items from 41 to 55 and from 60 to 73 are related to dimension of *necessity*. Items related to *advantage* dimension are from 1 to 11, from 15 to 23 and from 26 to 39. The items related to the disadvantage dimension are the 12th, 13th, 14th, 24th, 25th, 40th and from 56 to 59. When the factors and total scores are considered, it can be seen that the scale can distinguish the groups with different characteristics. The scale identifies perceptions of technology use in elementary education mathematics teaching. As the result of the negative questions scores was the reverse of it (in terms of total score and each factor), the high score that can be taken from the scale describes positive perception and the low score that can be taken from the scale describes negative perception. In this context, the scale allows the possibility of general survey and situation determination and date comparison.

The scale includes three dimensions. However, it is seen that certain items of the scale are gathered under certain headings. Starting from this, it is thought that examining the scale under these headings will contribute more to the field in terms of reflecting the general situation in depth in revealing the technological perceptions of the prospective teachers. When the data were analyzed, these headings were defined by the researcher. From the headings of the general contributions of using technology in elementary mathematics teaching for first 14 items of the scale, the followings were determined: the use of technology in teaching teachers mathematics

for the items from 15 to 25, the contribution of using technology to teach students mathematics for the items from 26 to 40, the necessity of using technologies in mathematics teaching for the items from 41 to 47, the necessity of using software in mathematics teaching for the items from 48 to 54, the evaluation of technology use in mathematics teaching in terms of elementary education mathematics program for the items from 55 to 59, actions to be taken for the realization of technology use in mathematics teaching effectively for the items from 60 to 73. As a result, the technological perception of prospective teachers in mathematics teaching was investigated under these headings. Descriptive and inferential statistical techniques were used when the data related to the perception of the prospective teachers about the use of technology in elementary education mathematics lessons were analyzed. Descriptive statistics includes data identification and presentation, and inferential statistics includes the processes of understanding, decision, or inferring about the characteristics of the distribution of the data (Gay and Airasian, 2000). In the study, data were analyzed using independent samples t-test and one-way variance analysis from inferential statistical techniques in the SPSS 21 statistical program.

FINDINGS AND DISCUSSION

Descriptive statistics

Tables 1 and 2 show the perceptions of prospective teachers about the use of technology in mathematics teaching based on frequency distributions of gender and grade level variables.

According to Table 1, it is seen that 271 of the prospective teachers who participated in the study constitute 77.1%, which means 209 of females and 22.9% which means 62 males.

It is seen that 64 (23.6%) of the 271 of prospective teachers who participated in the study are studying at first grade, 85 (31.4%) of them are studying at second grade, 67 (24.7%) of them are studying at third grade and 55 (20.3%) of them are studying at fourth grade.

Interpretive statistics

How significant is the difference in perceptions of prospective teachers in different genders on use of technology in mathematics teaching?

t-Test was used to analyze if there is a significant

Table 2. Frequency and percentage value of teacher candidates based on grade levels.

Grade levels	f	%
1 st grade	64	23.6
2 nd grade	85	31.4
3 rd grade	67	24.7
4 th grade	55	20.3
Total	271	100

Table 3. The results of the t-test on the perceptions of technology use in the mathematics teaching of the prospective teachers according to gender variables.

Gender	N	\bar{x}	Sd	df	t	Sig.
Female	209	272.6077	40.07792	269	1.703	0.090*
Male	62	262.5323	43.59076			

* $p > .05$.

difference in terms of gender in the perceptions of prospective teachers about the use of technology in mathematics teaching for independent samples. The results of the t-test on the prospective teachers' perceptions of technology use in mathematics teaching according to gender variables are presented in Table 3.

There is a difference of 8.49475 points in countenance of female prospective teachers' perception about the use of technology in mathematics teaching. The unrelated samples of whether this difference was significant were examined by t test and there was no significant difference between the technology use perception scores of prospective teachers [$t(269) = 1,703, p > .05$]. As a result, the perception scores of technology use of prospective teachers did not change significantly according to gender (Büyüköztürk, 2006). Similar results were obtained by Gök and Erdoğan (2010), Sayginer (2016), Şad and Nalçacı (2015) and Tsai et al. (2001) when the technology usage perception of prospective teachers was considered. For instance, Sayginer (2016) found that there was no significant difference between the scores of the prospective teachers' perception about the use of technology in education, depending on the gender variable. Some study results indicate that individual factors such as gender, grade point average, class/faculty rank, and length of tenure influence orientation toward technology from some aspects (Şendurur et al., 2012; Parker et al., 2008).

While there was no significant difference in the necessity and advantage sub dimensions of the scale in terms of gender, there was a significant difference in countenance of female prospective teachers in

disadvantage dimension ([tnecessity (269) = 1.891: $p > .05$], [tadvantage (269) = .914: $p > .05$], [tdisadvantage (269) = 2,409: $p < .05$]). As a result, the perceptions of female and male prospective teachers are similar in terms of the necessity and advantages of using technology in elementary education mathematics teaching. In terms of the disadvantages of the use of technology in elementary education mathematics teaching, the perception scores of female prospective are higher. Higher scores indicate a more positive perception as negative scores were made inversely (strongly disagree: 5,.... strongly agree: 1). At this point, it can be said that the male prospective teachers emphasize more the disadvantages of the use of technology in elementary education mathematics teaching.

How significant is the difference in perceptions of prospective teachers in different grade levels on use of technology in mathematics teaching?

In the mathematics teaching of prospective teachers, one-way ANOVA was used to analyze whether the perceptions of technology use vary according to grade level. The results on the prospective teachers' perceptions of technology use in mathematics teaching according to grade level variables are presented in Table 4.

According to the results of the analysis, there is a significant difference between the technology use perception scores of the prospective teachers. In other words, perceptions of technology use of prospective teachers vary significantly according to grade level. According to the results of the Scheffe test to find out the difference in which groups, the technology use perceptions of the prospective teachers who are studying at second grade ($\bar{x} = 284,6118$), who are studying at third grade ($\bar{x} = 288,1194$) and who are studying at fourth grade ($\bar{x} = 292,8182$) is detected as more positive than first grade prospective teachers ($\bar{x} = 213,2969$). This significant difference observed between the technology perceptions of the prospective teachers who are studying at first grade and the technology perceptions of the second, third and fourth grade prospective teachers is not observed from the second grade. This can be explained with the fact that the prospective teachers are receiving computer-aided education from the second grade and their computer use is gradually increasing in lessons thus, the difference is gradually decreasing. Internet applications and web design as optional courses in the fourth grade, Technology Integration in Mathematics Education and Technology Integration in Mathematics Teaching Design as a compulsory course in the third grade and besides this, the integration of mathematics education

Table 4. The results of the Anova on the prospective teachers' perceptions of technology use in mathematics teaching according to grade level variables.

Source of variance	Sum of Squares	df	Mean Square	F	p	Sig.
Between Groups	274532.414	3	91510.805	135,494	0.000	4-1, 3-1, 2-1
Within Groups	180328.774	267	675.389			
Total	454861.188	270				

*p<.05.

with technology in second grade is the subject as major area course. In the first grade, there are mainly general culture and mathematics major area courses and also there are computer lessons but it is limited by software and hardware knowledge.

There was a significant difference in grade level in three sub-dimensions as necessity, advantage and disadvantage of the scale ([F_{necessity} (3-267)= 199.949: p< 0.05], [F_{advantage} (3-267)= 53.122: p< 0.05], [F_{disadvantage} (3-267)= 63.477: p< 0.05]). In order to see which grade levels that this difference is from, Scheffe test that allows multiple comparisons was conducted. There was a significant difference between technology perceptions of first grade prospective teachers and technology perceptions of second, third and fourth grade prospective teachers in each dimension. As a result, perceptions of technology use of first grade prospective teachers in mathematics teaching are less than prospective teachers in other grade levels. There was no significant difference between the technological perceptions of the prospective teachers at the second, third and fourth grade levels.

Having a more positive opinion according to the necessity and advantage dimensions of the scale is observed in the second, third and fourth grade students. It is seen that first-grade students with lower scores in terms of disadvantages emphasize more the disadvantages of using technology compared to second, third, and fourth graders. Similarly, Akkaya (2016) identified that while training on technology integration increased middle school mathematics pre-service teachers' perceptions on the requirement and advantages of technology use in mathematics lessons, it did not affect their perceptions in terms of disadvantages of technology use in mathematics teaching.

How significant is the difference in perceptions of prospective teachers in different grade levels on general contributions of the use of technology in mathematics teaching?

This part of the work consists of findings of the data obtained with the responses of the prospective teachers

in the first 14 items (11 positive, 3 negative) of the perception scale. When the perceptions of prospective teachers in terms of general contributions to the use of technology in mathematics teaching are examined, it is seen that the views of facilitating teaching, making teaching enjoyable and facilitating access to information resources are in the forefront. These opinions are expressed by 70% and above of the prospective teachers. These findings are supported with the finding that most of the students found technology in educational settings useful and effective as obtained by Guerrero et al., (2004) and Gök and Erdoğan (2010). In the study carried out by Li (2007), it was stated that 87.3% of the students enjoyed using technology and believed that technology is an effective tool in learning and teaching process.

There are negative items in this section, but it is only one item that attracts attention. The rate of those who have positive opinions and those who do not have an opinion that the use of technology may cause problems were determined as 71.2%. As a result, it can be said that prospective teachers have positive perceptions in terms of general contributions of using technology in elementary education mathematics teaching. In order to see whether prospective teachers differ in terms of grade levels with regard to their general contributions to the use of technology in mathematics teaching were analyzed with one-way Anova and findings are presented in Table 5.

According to the results of the analysis, there is a significant difference between the perception scores of the prospective teachers in terms of general contributions of technology use [F(3-267)= 341,663: p< 0.05]. In other words, perceptions of prospective teachers in terms of general contributions of technology use significantly vary according to grade levels. According to the results of the Scheffe test to find out the difference in which groups, the technology use perceptions of the prospective teachers who are studying at second grade ($\bar{x}=53,7294$), who are studying at third grade ($\bar{x}=54,2836$) and who are studying at fourth grade ($\bar{x}=55,4727$) is detected as more positive than first grade prospective teachers ($\bar{x}=26,5469$) (Büyükoztürk, 2006). Unlike first-graders,

Table 5. The results of the one way Anova on the perceptions of prospective teachers in terms of general contributions of technology use in mathematics teaching according to grade level variables.

Source of variance	Sum of squares	df	Mean square	F	P	Sig.
Between Groups	37951,283	3	12650.428	341.663	0.000	4-1, 3-1, 2-1
Within Groups	9885,957	267	37.026			
Total	47837,240	270				

*p<0.05.

Table 6. The results of the one way Anova on the perceptions of prospective teachers in terms of contributions of technology use in mathematics teaching to teacher according to grade level variable.

Source of variance	Sum of squares	df	Mean square	F	P	Sig.
Between Groups	442,807	3	147.602	3.685	0.000	4-1
Within Groups	10693.532	267	40.051			
Total	11136.339	270				

*p<0.05.

second-, third- and fourth-grade prospective teachers think that the general contribution of technology is higher.

How significant is the difference in perceptions of prospective teachers in different grade levels on contributions to teacher of the use of technology in mathematics teaching?

This part of the work consists of findings of the data obtained with the responses of the prospective teachers from 15th to 25th items (9 positive, 2 negative) of the perception scale. When the perceptions of prospective teachers in terms of contributions of technology use in mathematics teaching to teachers are examined, it is seen that the views that it allows lessons to be planned and organized more, allows correlation of the subject with real life, increases motivation and creativity are at the forefront. These opinions are expressed by 70% and above of the prospective teachers. There are two negative items, but there was no remarkable item, and almost half of the prospective teachers were positive for the two items. As a result, it can be said that prospective teachers have positive perceptions in terms of contributions of using technology in mathematics teaching to teachers. In order to see whether prospective teachers differ in terms of grade levels with regard to contributions of technology use in mathematics teaching to teacher were analyzed with one- way Anova and findings are presented in Table 6.

According to the results of the analysis, there is a significant difference between the perception scores of

the prospective teachers in terms of contributions of technology use to teacher [F(3-267)= 3,685:p< 0.05]. In other words, perceptions of prospective teachers in terms of contributions of technology use to teacher significantly vary according to grade levels. According to the results of the Scheffe test for finding out the difference between the groups, the technology use perceptions of the prospective teachers who are studying at fourth grade ($\bar{x}=42,1273$) are more positive than first grade prospective teachers ($\bar{x}=38,3125$) (Büyüköztürk, 2006). Fourth grade prospective teachers have the opportunity to familiarize teaching profession and observe/ experience of the teaching profession personally with the school experience and teaching practice lessons. In this context, it can be said that the fourth grade prospective teachers think that technology use contributes more to teachers.

How significant is the difference in perceptions of prospective teachers in different grade levels on contributions to students of the use of technology in mathematics teaching?

This part of this work consists of the findings of the data obtained with the responses of the prospective teachers from the 26th to 40th items (14 positive, 1 negative) of the perception scale. When the views of the prospective teachers about the contributions of technology to students are examined, it was seen that they expressed positive opinions at 77% and above about the statements

Table 7. The results of the one way Anova on the perceptions of prospective teachers in terms of contributions of technology use in mathematics teaching to students according to grade level variables.

Source of variance	Sum of squares	df	Mean square	F	p	Sig.
Between Groups	858.042	3	286.014	5.509	0.000	4-1, 3-1
Within Groups	13860.918	267	51.914			
Total	14718.959	270				

*p<0.05.

that facilitate the understanding of the content, offering the opportunity to apply what they learnt, easier correlation of math with daily life, producing alternative solutions, providing like the lesson, increasing motivation and making one to enjoy lessons. Several studies (Ng and Gunstone, 2002; Kim et al., 2003; Nugent et al., 2006; Shyu, 2000) explored the influence of technology and concluded that technology could motivate students to learn mathematics.

While 32 prospective teachers were found to have negative opinions about having difficulty in learning basic concepts, 83 prospective teacher expressed that they are indecisive about this subject. Prospective teachers who are indecisive are predominantly studying in first and second grades. At this point, the fact that the field education lessons are limited at this grade level can be explained by the fact that the prospective teachers' general beliefs about mathematics education are newly formed. Schmidt and Callahan (1992) and Drier (2001a,b) indicated that many teachers feared that using technology would harm students' understanding of basic math concepts, make them overly dependent on technology, and not be effective as an instructional tool.

In order to see whether prospective teachers differ in terms of grade levels with regard to contributions of technology use in mathematics teaching to teacher were analyzed with one-way Anova and findings are presented in Table 7.

According to the results of the analysis, there is a significant difference between the perception scores of the prospective teachers in terms of contributions of technology use to students [$F(3-267)= 5,509;p< 0.05$]. In other words, perceptions of prospective teachers in terms of contributions of technology use to students significantly vary according to grade levels. According to the results of the Scheffe test to find out the difference in which groups, the technology use perceptions of the prospective teachers who are studying at second grade ($\bar{x}=57,6418$) and who are studying at fourth grade ($\bar{x}=59,0545$) is detected as more positive than first grade prospective teachers ($\bar{x}=53,9844$) (Büyüköztürk, 2006). Third and fourth grade prospective teachers have a more positive view on contributions to student than the first grade.

How is the prospective teachers' perception related to necessity of the technology used in mathematics teaching?

93.7% of elementary education mathematics prospective teachers expressed positive opinion on necessity use of internet, 85.6% of them of computer, 76% of them of video players, 66.1% of them of opaque projector, 57.2% of them of data projector, 50.5% of them of calculator, 38.8% of overhead projector. At this point, it is seen that prospective teachers indicate the necessity of internet and computer usage predominantly in teaching mathematics. This finding is consistent with the findings of previous studies. In the study carried out by Whetstone and Carr-Chellman (2001), it was seen that pre-service teachers considered computers as important tools. The most commonly implemented applications are those accessible on desktop computers, the Internet, and media, including programs such as PowerPoint, Word, Excel and other programs, both software and hardware. In the context of these changes, mobile phones can be used as a useful teaching device, providing teachers and learners with modern and automated techniques for achieving an educational target (Boyle, 2013).

Descriptive findings related to this situation are presented in Table 8. Prospective teachers were evaluated at their own grade level while frequency and percentage values were determined. For example, 38 of the 64 elementary education prospective teachers who participated in the study expressed positive opinions about the necessity of using the computer.

When Table 8 is examined, it is seen that the first grade prospective teachers on necessity of calculator use and prospective teachers at other grade levels on necessity of overhead projector use expressed lowest opinions. In addition, as the grade level increases, it is observed that it increases the percentage of opinions about the necessity of computer and internet use in teaching mathematics and decreases other technologies. It is noteworthy that from the second grade, the perceptions of prospective teachers about the necessity of computer and internet use in teaching mathematics were high and consistency.

It can be said that 93.7% which means the majority of

Table 8. Descriptive findings related to necessity of technologies in elementary education mathematics teaching.

Grade level	Computer		Calculator		Video players		Opaque projector		Data projector		Overhead projector		Internet	
	f	%	f	%	f	%	f	%	f	%	f	%	F	%
1 st grade	38	59.3	36	56.3	54	84.4	59	92.2	42	65.6	39	61	55	85.9
2 nd grade	79	93	51	64	63	74.1	54	63.6	47	55.3	27	31.8	81	95.3
3 rd grade	63	94	24	35.9	50	74.6	32	47.7	33	49.2	21	31.4	64	95.5
4 th grade	52	94.5	26	47.2	39	70.9	34	61.9	33	60	18	32.8	54	98.2
Total	232	85.6	137	50.5	196	76	179	66.1	155	57.2	105	38.8	254	93.7

Table 9. Descriptive findings related to necessity of software in elementary education Mathematics teaching.

Grade level	Spreadsheet		Data presentation		Drawing /Coloring		Application software		Education software		Animations		Modellings	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1 st grade	59	92.2	59	92.2	59	92.2	59	92.2	51	79.7	41	64.2	42	65.6
2 nd grade	65	76.5	75	88.2	67	78.9	75	88.3	78	91.7	79	92.9	80	94.1
3 rd grade	53	89.1	52	77.6	38	56.7	61	91.1	65	97	63	94.1	62	92.5
4 th grade	47	85.5	43	78.2	39	71	52	94.6	52	94.5	53	96.4	53	96.4
Total	224	82.6	229	84.5	203	74.9	247	91.1	246	90.7	236	87.1	237	87.5

prospective teachers emphasize the necessity of internet use and that internet use is an important factor in teaching mathematics. Approximately half of the prospective teachers have a positive perception in the use of calculator. This may be presented as a reason why calculator needs to be used at a simple level and in certain courses (for example statistics and probability, physics lessons). However, the rate of calculator use in first grade prospective teachers is lower than other technologies. This can be explained by the limited or no use of calculator in the lessons in the curriculum for the first graders. It can be said that first graders are familiar with the use of other technologies except calculator for education lessons and research assignments given by professors. At this point, it is possible to reach the conclusion that applications should be given more place in education in order to use calculator effectively.

How is the prospective teachers' perception related to necessity of the software used in the elementary education mathematics teaching?

82.6% of prospective teachers expressed positive opinions on usage of spreadsheet, 84.5% of them on data presentation, 74.9% of them on drawing and coloring, 91.1% of them on application software (cabrietc.) special to mathematics field, 90.7% of them on various education software (vitamin, skool etc) about

mathematics field, 87.1% of them on animations and 87.5% of them on modeling necessary in mathematics teaching. Findings related to these are given in Table 9.

When the data in Table 9 are examined, it is seen that 74% and above of the prospective teachers need to use all software in mathematics teaching. However, these ratios have increased in application and educational software. This may be presented as a reason to use this kind of software effectively in education lessons. For drawing and coloring, which has the lowest rate, as the grade level increases, it could be that these applications are less included or needed in the lessons for third and fourth grades. Contrary to other grade levels, drawing and coloring requirements are higher in first grade. It can be said that in this result, Analysis and Geometry lessons are mainly determined as effective in the first class program. Lack of field education lessons and practices that will allow them to have knowledge of how to use animations and modeling in mathematics teaching at first grade may have reduced the need for these. Spreadsheet and drawing / coloring requirements for second grade prospective teachers have low rates. It can be said that they see how to use other software in education with practices with the newly taken field education lessons were reinforced the views of second grade prospective teachers on necessity of these. As an example of drawing / coloring technology, Herdem et al. (2014) explored the concept cartoons and technology use perceptions and found out that the positive aspects of the

Table 10. The results of the one way Anova on the perceptions of prospective teachers in terms of technology use in the elementary education mathematics curriculum according to grade level variable.

Source of variance	Sum of Squares	df	Mean Square	F	p	Sig.
Between Groups	1246.081	3	415.360	32.943	0.000	4-1, 3-1, 2-1
Within Groups	3366.458	267	12.608			
Total	4612.539	270				

* $p < 0.05$.

technology were emphasized by the students. Li (2007) stated that students' view about specific software in mathematics and science learning was another topic of exploration and Akkaya (2016) stated that teachers are also expected in the mathematics teaching program to effectively and relevantly use information and communication technologies (dynamic geometry software, virtual learning objects, graphing calculators, smart board etc). Previous studies indicate that although mathematics teachers and pre-service teachers have positive perceptions about technology, they can partially use technology during class (Bauer and Kenton, 2005; Bozkurt and Cilavadroğlu, 2011; Demiraslan and Usluel, 2005; cited by Akkaya, 2016).

How significant is the difference in perceptions of prospective teachers in different grade levels of the use of technology in mathematics education program?

This consists of the findings of the data obtained with the responses of the prospective teachers from the 55th to 59th items (1 positive, 4 negative) of the perception scale. Prospective teachers' perceptions about the program support the use of technology positively. When the responses given to the negative items are examined, it is seen that 70% of the prospective teachers expressed that when the program is conducted time could be a limiting factor. This finding obtained in the study are in parallel with the findings that most of the teachers considered technology as extra work load for both teachers and students; and its educational value was low in terms of the spent time and effort (Gök and Erdoğan, 2010).

To know whether technology use in teaching mathematics changed according to the grade level in terms of elementary education mathematics curriculum, the collected data were analyzed with one-way Anova and findings are presented in Table 10.

According to the results of the analysis, there is a significant difference between the perception scores of prospective teachers in terms of technology use in elementary education mathematics curriculum [$F(3-267) = 393,337; p < .05$]. In other words, the perceptions of prospective teachers about things to be done for effective

use of technology significantly vary according to grade level. According to the results of the Scheffe test for finding out the difference between the groups, the technology use perceptions of the prospective teachers who are studying at second grade ($\bar{x} = 17,2353$), third grade ($\bar{x} = 18,5672$) and fourth grade ($\bar{x} = 17,6182$) are more positive than first grade prospective teachers ($\bar{x} = 12,8594$) (Büyükoztürk, 2006).

How significant is the difference in perceptions of prospective teachers in different actions to be taken for the realization of technology use in mathematics teaching effectively?

This consists of the findings of the data obtained with the responses of the prospective teachers from 60th to 73th items of the perception scale. When the opinions of the prospective teachers about the perceptions on the things to do for the effective use of technology in elementary mathematics education are examined, it is seen that the perceptions are in the positive direction, but two items are noticeable: the development of technology competencies of teachers / prospective teachers and the provision of adequate support to the teachers of technology by schools. As a result, it is seen that the prospective teachers clearly reveal the things to be done to effectively use technology in mathematics teaching as increasing of in-service training and providing school technological equipment. To know whether the perceptions of prospective teachers about the things to be done for effective use of technology in mathematics teaching differ according to grade levels, the data collected were analyzed with one way Anova and findings are presented in Table 11.

According to the results of the analysis, there is significant difference between the perception scores of prospective teachers about things to be done for technology to be used effectively [$F(3-267) = 393,337; p < .05$]. In other words, the perceptions of prospective teachers about things to be done for technology to be used effectively significantly vary according to grade level. According to the results of the Scheffe test for

Table 11. The results of the one way Anova on the perceptions of prospective teachers related to things to be done for the realization of effective technology use in mathematics teaching according to grade level variable.

Source of variance	Sum of squares	df	Mean square	F	p	Sig.
Between Groups	57695.464	3	19231.821	393.337	0.000	4-1, 3-1, 2-1
Within Groups	13054.713	267	48.894			
Total	70750.177	270				

*p<0.05.

finding out the difference between the groups, the technology use perceptions of the prospective teachers who are studying at second grade ($\bar{x}=61,0941$), third grade ($\bar{x}=62,7015$) and fourth grade ($\bar{x}=62,3455$) are more positive than first grade prospective teachers ($\bar{x}=27,6250$) (Büyüköztürk, 2006).

RESULTS AND SUGGESTIONS

Researchers (Demetriadis et al., 2002; Pelgrum, 2001) also identified teachers' perceived obstacles. The most commonly cited obstacles to the integration of technology in education were: (1) material conditions (including an insufficient number of computers and technology expertise among teachers); (2) difficulty integrating technology into the regular curriculum and instruction; and (3) lack of supervisory and technical staff. In order to prepare students for the future and help them learn how to think, learn, and gain different perspectives, technology has to be integrated into the classroom (Eyyam and Yaratana, 2014; Sezginsoy-Şeker, 2018). Technology is constantly changing; the need for school systems to create effective technology integration into the classroom requires that teachers be adequately trained (Brooks-Young, 2007; ChanLin, 2005; Gordon, 2011; Pepe, 2016). In this respect, it has become crucial to equip prospective teachers with combined knowledge on technology, content knowledge and pedagogical knowledge (Akkaya, 2016; Mishra and Koehler, 2006; Niess and Garofalo, 2006; Öksüz et al., 2009; Öksüz and Ak, 2009). There was a need for this study because it informs educators regarding technology use perceptions of prospective teachers in mathematics teaching programs. A clearer understanding of how prospective teachers perceived technology integration mathematics teaching may improve prospective teachers' participation in technology integrated mathematics lessons.

In the study, data were gathered using the perception scale including the necessity, advantage and disadvantage related to the use of technology in elementary mathematics lessons by the teachers / prospective teachers developed by Öksüz et al. (2009).

The data have also been analyzed under these determined headings, in the light of these sub-dimensions as well as the idea that they will allow a detailed examination of the technological perceptions of the prospective teachers.

The results obtained from this study are:

1. The general contributions of technology use in mathematics teaching, its contributions to teacher and students; the necessity of using technologies; the necessity of using software; the evaluation of technology use in terms of elementary school mathematics curriculum and the necessary steps that must be taken to ensure that technology is effectively used.
2. The technology use perception of prospective teachers who are studying at different grade levels showed a significant difference in elementary education mathematics lessons. This situation is also similar with the necessity, advantage and disadvantage sub-dimensions of the scale.
3. The technology use perceptions of the second, third and fourth grade prospective teachers are more positive in terms of necessity and advantage sub-dimensions than the first grade prospective teachers. Contrary to this, the first grade prospective teachers emphasize more on the disadvantages of technology use.
4. According to the gender variable, it was determined that the technological perceptions of the prospective teachers did not change. However, there was a significant difference in disadvantage dimension while there was no difference in terms of gender in sub-dimensions of necessity and advantage. In this context, it was achieved that male prospective teachers emphasize more on the disadvantages of technology use.
5. When the contributions of technology use to students in mathematics teaching are examined, it was determined that second, third and fourth grade prospective teachers have more positive perceptions of technology use than the first grade prospective teachers.
6. When the contributions of technology use in mathematics teaching to teacher was examined, significant difference came from the first and fourth grade prospective teachers. As a result, it is seen that fourth grade prospective teachers think that using technology in mathematics teaching contributes more to teacher.

7. When the contributions of technology use to students in mathematics teaching are examined, it was determined that third and fourth grade prospective teachers have more positive perceptions of technology use than the first grade prospective teachers.

8. When technologies use in mathematics teaching are examined, almost all of the prospective teachers indicate the necessity of internet use. The first grade prospective teachers expressed opinions on necessity of calculator use and prospective teachers in other grade levels expressed opinions on necessity of overhead projector use.

9. It has been determined that 74% of the prospective teachers need all the software in mathematics teaching. Prospective teachers prefer to use more applications and educational software, animations and modeling in mathematics teaching.

10. In terms of things to be done to use technology for both mathematics curriculum and being more effective, second, third and fourth grade prospective teachers are more positive than first grade prospective teachers. Prospective teachers emphasized that the program is suitable for technology use, time factor can be a negative effect and that the use of technology can be more effective by increasing the in-service training and providing the school with technology equipment.

The mathematics curriculum, which has been updated in recent years, highlights the development of individuals with digital competence who can effectively use technology and mathematics in their daily lives. At this point, it is emphasized that instructional technologies play a complementary role, not an option for teaching mathematics (Mathematics Course Teaching Programs, 2018). Taking into account the effective use of technology in teaching mathematics, the followings are considered: 1) Technology-supported material and resources to be used by teachers, prospective teachers and students are prepared in Turkish and pursue updated mathematics curriculum; 2) prospective teachers have sufficient level of technological pedagogical content knowledge in their first degree; 3) in the context of teaching practice lesson, they gain experience by forming environments that will enable them to develop this knowledge by designing education with the help of mutual studies, practical teachers and lecturer; 4) providing technological equipment to schools; 5) the ability to use powerful computer software and digital materials in the teaching of subjects that students have difficulty in such as algebra, geometry, statistics and probability; 6) dissemination of e-content within the scope of EIN.

While changes and reform are needed in schools to effectively implement technology integration into the classroom, there must be sufficient pre service/ in service training available for educators, teachers and also prospective teachers. Integrating technology into the

classroom can be achieved by developing projects that help teachers meet curriculum standards, cover content, and implement school policies. To be successful, projects that use technology should have clear, targeted teaching and learning outcomes that are consistent with the technology in use (Debele and Plevyak, 2012); that is, the use of the technology aligns with, or is compatible with instructional practice. Examples of integrating technology into the curricula include prospective teachers using software and devices in mathematics teaching. Ritzhaupt et al. (2012) stated that the number of years teaching and school level of professional development both had direct, significant effects on technology use or integration at the classroom level and student use of technology. As the grade level increases, the idea of computer and internet use in mathematics teaching should be more included. With this, it can be said that the study revealed the general situation in terms of each grade level of technology use perception of prospective teachers in mathematics teaching. In the scope of teaching practical lesson, as a continuation of this study, lesson plans based on instructional technologies can be developed, practical examples can be presented, and prospective teachers' technology perceptions in mathematics teaching can be investigated through in-depth interviews and observations. In addition to this study, teacher's perceptions of technology use in schools and teachers' perceptions of factors influencing technology integration in mathematics teaching could be other research topics.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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