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Determining the Level of Familiarity and the Use of Course Equipment among Pre-Service Mathematics Teachers

Mustafa Albayrak[1], Ercan Özdemir[2] and M. Nuri Kültür[3]

[1]Ataturk University, Kazım Karabekir Education Faculty, Department of Primary Mathematics Education, 25240, Erzurum, Turkey ; [2, 3] Ataturk University, Kazım Karabekir Education Faculty, Department of Secondary Science and Mathematics Education, 25240, Erzurum, Turkey

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ABSTRACT

The present study aimed to determine the degree to which pre-service teachers are familiar with and use the course equipment required for teaching mathematics in elementary schools. It was carried out with 196 pre-service teachers who completed an undergraduate programme for elementary mathematics teacher education. The study employed case study as a qualitative research method. A five-point Likert-type scale of 24 items was used as the data collection instrument. Furthermore, interviews were held with 32 pre-service teachers. The results revealed that the pre-service teachers did not sufficiently use the course equipment required for teaching mathematics during their pre-service period. The pre-service teachers stated that they would compensate for their inadequacy during their in-service period.

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Keywords:
Pre-service teachers, course equipment, use of materials, mathematics teaching

Introduction

Technology is used in education environments to facilitate learning and teaching. Using technology and course equipment in teaching has numerous benefits. Course equipment is used to save time, to contribute to students' personality development, to activate students instead of offering them monotonous teaching, to motivate students, to reduce personal differences and to help students acquire information skills. Teaching activities can be made more interesting by physical adjustment of all kinds of learning-teaching environments in accordance with the teaching content at hand. Furthermore, the use of novel methods and techniques in teaching is effective in making education more qualified by the help of concrete and semi- concrete audio-visual course equipment. For this purpose, countries are striving to provide schools with educational equipment (tablet PC, smart board, etc…) depending on technological developments and within their economic means.

Equipment use in education creates an effective teaching-learning environment and thus plays an important role in helping students attain predetermined goals and the success of a followed programme. This is crucial for an effective education environment (Karamustafaoglu, 2006). The use of equipment not only ensures a multiple learning environment and also helps meeting students' individual needs. Course equipment simplifies abstract and complicated phenomena and events (Akcay, Feyzioglu, and Tuysuz, 2003).

Teaching equipment should be developed in advance and be in line with curricular requirements. For Yalin (2004), teaching equipment can be defined as different ways and environments through which

[1]Corresponding author's address: Ataturk University, Kazım Karabekir Education Fakulty, Department of Primary Mathematics Education, 25240, Erzurum, Turkey
Telephone: 0442-2314270
Fax: 0442-236-0814
E-mail, www.albayrak@atauni.edu.tr

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knowledge can be transmitted to the learner. Kaya (2006, p.26) defines it as the tools presented by a teacher to students in various environments within the learning process. For selecting relevant and appropriate materials, it is necessary to acquire the correct information in advance about the content to be taught and the individuals in the target group. This requirement is confirmed by the research on the use of equipment in classes (Altiboz, 2001; Altintas, 1998; Boster et al., 2002; Fidan, 2008; Kaya, 2006; Kazu and Yesilyurt, 2008; Ruzgar, 2005). Course equipment should be employed to create an effective teaching environment. Using teaching equipment directly influences the accomplishment of the educational objectives in learning-teaching process (Kazu and Yesilyurt, 2008).

Course equipment significantly contributes to ensuring meaningful learning. Margarat (2000) argues that teaching equipment influences what and how learners learn (cited in Dede, 2007). Particularly when it comes to teaching abstract subjects, the use of concrete tools and semi-abstract (images, figures) equipment facilitates comprehension. Kazu and Yesilyurt (2008) identified the purposes of teachers' use of teaching equipment as to want greater student accomplishment, to help students acquire greater knowledge and more skills, to enhance their course achievement and make course teaching enjoyable, to help them learn by doing, and to assist their retention of information.

Elementary school is a level of education that requires intensive applications based on educational technology because students at this level feel greater need for learning by concrete learning experiences in accordance with their development levels. Furthermore, it is often easier for students to visualize the things that they always perceive as concrete and to associate them with abstract concepts in time. Therefore, if possible, students should be directly exposed to things, objects, and tools that are relevant to the course subject; and when that is not possible, they should be shown a model, photograph or another symbol of the object in question (pictures, images, slides, films, etc.). This method complies with the concrete-to-abstract principle adopted in mathematics teaching (Albayrak, 2010). In this process, the use of audio-visual equipment in particular at all education levels and for all course subjects significantly facilitates learning. Thus, it becomes possible to transmit greater amount of knowledge to more students in less time.

In a study investigating teachers' views about the use of equipment in elementary education, Fidan (2008) concluded that teaching with equipment is more efficient and effective. The teachers stated that using teaching equipment ensures retention of learning in students, promotes students' interest in the course, helps them learn by entertaining, increases their active participation in classes, and facilitates the transfer of learnt information to daily life. In the same study, mathematics teachers also stated that they used tangrams, transparent cards, sticks, computers, set-squares, protractors, plastic sticks, models, geometric shapes, and ruler sets in their classrooms.

Yildirim (2000) found that 30.24% of teachers did not use audio-visual materials in their classes, while 57.71% only used them partially. Dede (2007) investigated students' opinions about the way mathematics is taught. In the study, sixth-, seventh-, and eighth-grade students stated that materials and resources are used once or twice a month in classes. In the same study, high school students stated that they rarely employed materials in classes.

Ersoy (1996) noted that course equipment is not used in teacher training. Kucukahmet (2002, p.109) attributes the fact that some teachers avoid using even the simplest tools due to their lack of knowledge about how to use these tools. Tuy (2002) ascribes the lack of equipment use among teachers to their lack of required knowledge and skills, noting that the problem could be solved through in-service training. According to Akpinar (2003), teachers find the time spent to prepare teaching equipment and tools long or too long (66% of 510 teachers participating in the study). The same study also found a significant difference between the degrees to which teachers graduating from different faculties directly use technological resources in teaching activities.

Shortcomings in the use of course equipment may originate either from teachers and students or from curricula. Introduction of the equipment to be used for mathematics teaching in mathematics curriculum has filled an important gap, because tools such as abacuses, calculation sheets and charts, mechanical calculators, electronic calculators, and computers should be employed in mathematics education (Ersoy, 1997). The Elementary Mathematics Curriculum introduced in 2005 contains the names and pictures of the equipment and tools suggested for use in elementary mathematics courses: "decimal blocks, unit cubes, geoboards,

pattern blocks, symmetry mirrors, tangrams, fraction sets, transparent fraction cards, geometric strips, decimal cards, transparent counting chips, sets of geometric figures, isometric paper, dotted paper, hundreds card, and hundred charts" (MEB, 2005a, s.327-333; MEB, 2005b, s.351-358). 2005 elementary mathematics curriculum for grades 1-5 and 6-8 encourages the use of equipment by the following statement: "audio-visual and printed tools and equipment are used in teaching activities to assist acquisitions" (MEB, 2005a, s.9; MEB, 2005b, s.9).

Peker and Halat (2008) investigated the opinions of elementary teachers about the 2005 Elementary Mathematics Curriculum. On the dimension of educational situations, the teachers believe that the use of technology is not common in mathematics classes. In addition, they maintained that there were also certain deficiencies with regard to the use of tools and equipment to enhance students' motivation toward the course (Peker and Halat, 2008).

As is clear from the literature, there are persistent problems with regard to the production, provision, and use of tools and equipment required for educational environments. Clearly, we need to get to the source of the problem to minimise the challenges concerning the use of equipment required for course teaching. With this aim in mind, the present study attempted to determine the degree to which pre-service teachers use the course equipment in the elementary mathematics curriculum during their undergraduate education.

Research Problem

How well and often are pre-service elementary mathematics teachers familiar with and use the course equipment suggested for use in elementary mathematics courses?

Method

Case study was used in the study as a qualitative research method. According to Gall, Borg, and Gall (1996), as cited by Buyukozturk et al. (2009), case studies are done a) to produce detailed descriptions of a phenomenon, b) to develop possible explanations of it, or c) to evaluate the phenomenon.

Study Group

The study was conducted with 196 pre-service teachers who had completed their undergraduate education in the elementary mathematics teacher training department at a public university. The subjects were selected from among students who had completed their education so that they could more freely express their opinions about the problem. The study was carried out in June during the spring semester of the academic year 2009–2010.

Data Collection Instrument

The first data collection instrument used is a 24-item five-point Likert-type questionnaire developed by the researchers. The instrument's Cronbach's Alpha reliability coefficient was computed to be 0.84. In order to ensure its validity, faculty members' opinions were taken and the literature on the Ministry of National Education Elementary Mathematics curriculum (1^{st} to 8^{th} grades) was reviewed. The first part of the questionnaire contains 21 items, which involve the tools and equipment to be used for mathematics course such as algebra tiles, fraction sets, meters, and compasses. The second part includes 3 items that aim to identify the pre-service teachers' views about course equipment. The second data collection instrument is interviews held with the pre-service teachers. Interviews were optional and aimed to compile the pre-service teachers' additional ideas, other than those they mentioned in the questionnaire. 32 pre-service teachers participated in the interviews.

Data Analysis

In the data collection instrument, the response codes corresponding to each item range between 1 and 5. For the first part of the questionnaire, the rating scale involved "5; Used it, 4; Seen but not used, 3; Heard of it, 2; Seen a picture of it, 1; Never seen it". As for the second part, the rating options included "5; Strongly agree, 4; Agree, 3; Partly agree, 2; Disagree, and 1; Strongly disagree". Frequency was employed to determine the frequency levels of the pre-service teachers' responses in the Likert-type test, while arithmetic means were computed to determine the tendency of the sample for each test item. In order to determine the ranges of levels when interpreting arithmetic means, the difference between the highest and lowest value in the choices was divided by series width (the number of choices) and a range of 0.80 was obtained. Thus, for the first part of the scale, the values between 1.00-1.80 represent *"Never seen it"*, those between 1.81-2.60 represent *"Seen a picture of it"*, those between 2.61-3.40 represent *"Heard of it"*, those between 3.41-4.20 represent *"Seen but not used"*, and those between 4.21-5.00 represent *"Used it"*. As for the second part of the questionnaire, the values between 1.00-1.80 represent *"Strongly Disagree"*, the values between 1.81-2.60 represent *"Disagree"*, those between 2.61-3.40 represent *"Partly Agree"*, those between 3.41-4.20 represent *"Agree"*, and those between 4.21-5.00 represent *"Strongly Agree"*.

No limit was set for the interviews.

Results and Discussion

The opinions of the pre-service teachers about the equipment to be used in mathematics education courses are tabulated. To make it simpler to interpret the results, five tables were made from the most commonly used materials to the least commonly used.

Table 1. The use of course equipment among pre-service elementary mathematics teachers

Equipment	1	2	3	4	5	Mean
Meter	8	12	16	52	108	4.22

Table 1 presents the frequency values and means for the results regarding the "meter" equipment. As is clear from the results, 108 pre-service teachers rated *"Used it"*, while 4 checked *"Never seen it"* and the mean for this course equipment is 4.22, which corresponds to the level of *"Used it"*. This result suggests that the pre-service teachers have used meter in their undergraduate course or in any other ways. Among 21 course equipment mentioned in the questionnaire, meter is the material with the highest mean. This highest mean score for the meter as a material is attributed to its common use for daily tasks, its portability, and easy access.

Table 2. The use of course equipment among pre-service elementary mathematics teachers

Equipment	1	2	3	4	5	Mean
Protractor	32	12	20	48	84	3.71
Compass	24	4	12	64	92	4.00
Litre	12	16	32	40	96	3.98
Square meter	20	12	36	64	64	3.71
Cubic centimetre	18	6	18	28	28	3.43

The course equipment shown in Table 2 have a mean score ranging between 3.41 and 4.20, which corresponds to the level *"Seen but not used"*. Following the meter, the second most commonly used equipment among the pre-service teachers is in this group. According to the data in the table, the course

equipment with the highest mean score is the compass, while cubic centimetre has the lowest mean. For compass, 92 pre-service teachers rated *"Used it"*, while 24 rated the response *"Never seen it"*; as for cubic centimetre, 56 pre-service teachers rated the response *"Used it"*, while 36 rated *"Never seen it"*.

Table 3. The use of course equipment among pre-service elementary mathematics teachers

Equipment	1	2	3	4	5	Mean
Geometric Strips	60	12	52	68	4	2.71
Tangram	36	16	32	64	48	3.37
Symmetry Mirror	60	16	52	56	12	2.71
Unit Cube	36	28	60	24	48	3.10

The course equipment in Table has a mean score ranging between 2.61 and 3.40, which corresponds to the level *"Heard of it"*. The most frequently used equipment in this group is the *"tangram"*, *while the "symmetry mirror and geometric stripes"* are the least common ones. 48 pre-service teachers said *"Used it"* and 18 said *"Never seen it"* for the tangram, while for the symmetry mirror, 12 pre-service teachers rated *"Used it"* and 60 rated the response *"Never seen it"*.

Table 4. The use of course equipment among pre-service elementary mathematics teachers

Equipment	1	2	3	4	5	Mean
Algebra Tiles	124	8	44	12	8	1.84
Capacity Team	132	4	32	20	8	1.82
Ornament Sets	104	32	36	24	0	1.90
Isometric Paper	72	44	40	32	8	2.29
Dotted Paper	64	44	52	24	12	2.37
Transparent Fraction Cards	108	20	52	12	4	1.90
Base Ten Blocks	72	16	60	32	16	2.51
Geoboard	60	20	84	20	12	2.51

The mean score for the course equipment in Table 4 ranges between 1.81 and 2.60, corresponding to *"Seen a picture of it"*. Within this group, the materials most commonly seen by the pre-service teachers were *base-ten blocks and geoboards*, while the least common equipment was the *capacity team.* 16 pre-service teachers rated *"Used it"*, while 72 said *"Never seen it"* for base-ten blocks; and for the volume set, 8 pre-service teachers said *"Used it"*, while 132 rated the response *"Never seen it"*.

Table 5. The use of course equipment among pre-service elementary mathematics teachers

Equipment	1	2	3	4	5	Mean
Polycubes	128	12	40	12	4	1.73
Polysquares	120	24	36	16	0	1.73
Fraction Set	104	36	48	8	0	1.80

The course equipment in Table 5 have a mean score between 1.00 and 1.81, which corresponds to the *"Never seen it"* category. The materials in this group are among the least common ones. For polycubes, 4 pre-service teachers said *"Used it"*, while no pre-service teacher provided the response "*Used it*" for polysquares and the fraction set.

The second part of the questionnaire aimed to determine what pre-service elementary mathematics teachers think about course equipment. The first item in this part reads *"It is not important to know course equipment"*. The pre-service teachers' responses to this item have a mean of 1.89, corresponding to the *"Disagree"* category. From this result, it could be concluded that the pre-service teachers can adequately appreciate the importance of course equipment. The second item in this part is *"I will compensate for my shortcomings when I become a teacher"*. The pre-service teachers' responses had a mean of 3.71, corresponding to the *"Agree"* level. Obviously, the pre-service teachers are aware of their shortcomings with regard to course equipment. This item and the first one could be collectively interpreted to indicate that the pre-service teachers recognize the importance of and their shortcomings about course equipment. The third item in this section reads *"I can develop my course equipment myself"*. This item had a mean of 3.51, which corresponds to the *"Agree"* level. Therefore, it could be argued that the pre-service teachers have almost total confidence in their psychomotor skills. However, the results obtained from the first part of the questionnaire suggest that their pre-service knowledge is not enough to do that because it was found that the pre-service teachers were closely acquainted with only 6 among the 21 course materials mentioned in the first part of the questionnaire. Of these materials, the meter lies in the *"Used it"* category, while protractor, compass, litre, square meter and cubic meter are in the *"Seen but not used"* category. Therefore, this might indicate that the pre-service teachers are not closely acquainted with most of the course equipment.

In the study, 32 pre-service teachers were interviewed about the subject. Below is a summary of their opinions:

-In the instruction technology and material development course, we have not developed any models for the equipment mentioned in the questionnaire.

-In the courses about professional teaching knowledge, we often employed power-point presentations instead of using tangible materials.

-We can develop course materials by ourselves and compensate for our shortcomings when we become teachers.

-In the school experience and teaching practice courses, we observed that some of the school teachers disregarded the use of equipment.

Interestingly enough, out of 21 course materials, for which the present study attempted to determine the usage levels by pre-service teachers in the present study, 15 corresponded to the categories of *"Heard of it"*, *"Seen a picture of it"*, *and "Never seen it"*. In other words, the pre-service teachers never used these materials in the classroom environment during their faculty courses and school practice courses. This is primarily attributed to the common use of technology (particularly power-point presentations) in faculty courses. The frequent use of power-point presentations instead of tangible materials in field instruction/education and special teaching methods courses raises some concern. It is important to use time, place, method and duration appropriately when using technology in course activities. Inconvenient and ineffective use of teaching materials will clearly fail to provide the desired benefit for teaching.

Conclusions and Suggestions

Apart from their advantages such as promoting students' motivation toward the course, creating different learning environments, and transforming abstract concepts into semi-abstract or concrete ones, course equipment is particularly used to improve psychomotor skills. The following objectives were laid down to improve the psychomotor skills of elementary students in 1st-5th and 6th-8th grades. Effective use of equipment and materials such as hundreds tables, decimal tables, base-ten blocks, tens and hundreds squares, fraction cards, dotted and isometric paper, tangrams, compasses, rulers, and set-squares is aimed for (MEB, 2005a, p.17; MEB, 2005b, p.18). The present study attempted to determine how frequently the

above mentioned course materials are used by pre-service elementary mathematics teachers and what they think about course equipment.

One study conclusion is that the pre-service teachers most commonly used the meter, while the least common (or almost non-used) course equipment include polycubes, polysquares and the fraction set.

In light of the pre-service teachers' responses to the questionnaire and interview questions, the most significant conclusion of the study is that course equipment are not used adequately. This is mainly attributed to the intensive technology use in faculty courses. This result concerning the insufficient use of materials is in parallel to the results of Dindar and Yaman (2003), Koseoglu and Soran (2005), and Karamustafaoglu (2006), all of whom concluded in their studies that teachers do not adequately use materials in their courses.

Another conclusion of the study concerns the awareness among the pre-service teachers of the importance of course equipment and their relevant shortcomings. This result is consistent with a result of Guven (2006), who reported that the pre-service teachers in the sample recognised that using teaching technologies and materials would enhance the effectiveness of teaching. Another result is the pre-service teachers' belief that they can develop course equipment themselves and compensate for their related shortcomings during their in-service period. This result is in parallel to the studies of Guven (2006), Koseoglu and Soran (2005), and Karamustafaoglu (2006), who reported that the pre-service teachers in their samples are willing to develop teaching materials.

In light of the study results, some suggestions are made about the use of course equipment and for further research.

1. In addition to technology use, course materials such as meter, compass, ruler, protractor, geoboard and fraction cards can be used in courses.

2. In courses about professional teaching knowledge like special teaching methods, pre-service teachers can be introduced to applications about which course materials should be used for which subject.

3. Pre-service teachers can be asked to develop relevant course equipment which they can prepare through their own means without going to any extremes.

4. Pre-service teachers can be encouraged for developing and using course equipment and materials in courses about professional teaching knowledge such as special teaching methods, instruction technologies and material development.

5. The same study could be carried out with different sample groups and the results could be compared.

References

Albayrak, M. (2010). İlköğretimde matematik ve öğretimi-I, Erzurum: Mega Ofset Matbaası.

Akçay, H. Feyzioğlu, B. Ve Türsüz, C. (2003). Kimya öğretiminde bilgisayar benzeşimlerinin lise öğrencilerinin başarısına etkisi, Kuram ve Uygulamada Eğitim Bilimleri, 3(1), 7-26

Akpınar, Y. (2003). Öğretmenlerin yeni bilgi teknolojileri kullanımında yükseköğretimin etkisi: İstanbul Okulları Örneği, The Turkish Online Journal of Educational Techonology, TOJET, 2(2)

Altıboz, G.N. (2001). Lise 1. sınıf öğrencilerinde hücre ve moleküler biyoloji konuları ile ilgili görsel ve deneysel malzeme kullanmanın başarı üzerine etkisi, Yayınlanmamış Yüksek Lisans Tezi, Gazi Üniversitesi

Altıntaş, G.E. (1998). İlköğretim okulları 4. sınıf fen bilgisi öğretiminde araç-gereç ve bulmaca tekniğinin öğrencilerin akademik başarısına katkısı, Yayınlanmamış Yüksek Lisans Tezi, Denizli Pamukkale Üniversitesi

Boster, F.J., Mayer, G.S., Roberto, A.J., and Inge, C.C. (2002). A report on the effect of the united streaming application on educational performance, United Learning

Büyüköztürk, Ş., Çakmak, K.E., Akgün, E.Ö., Karadeniz, Ş. ve Demirel, F. (2009). Bilimsel araştırma yöntemleri (3. Baskı), Ankara: Pegem Akademi

Dede, Y. (2007). Matematiğin öğretim biçimine ilişkin öğrenci görüşleri, AİBÜ, Eğitim Fakültesi Dergisi, 7(2), 17-33

Ersoy, Y. (1996). Hizmetiçi eğitim ve yetiştirme kursunu geliştirme-I: Amaçlar ve matematik öğretmenlerinin görüşleri, Hacettepe Eğitim Fakültesi Dergisi, 12, 151-160

Ersoy, Y. (1997). Okullarda matematik eğitimi: Matematiksel okur-yazarlık, Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 13, 115-120

Fidan, K.N. (2008). İlköğretimde araç gereç kullanımına ilişkin öğretmen görüşleri, Kuramsal Eğitimbilim, 1(1), 48-61

Karamustafaoğlu, O. (2006). Fen ve teknoloji öğretmenlerinin öğretim materyallerini kullanma düzeyleri: Amasya İli Örneği, AÜ Bayburt Eğitim Fakültesi Dergisi, 1(1), 90-101

Kaya, Z. (2006). Öğretim teknolojileri ve materyal geliştirme (2. Baskı) Ankara: PegemA Yayıncılık

Kazu, H. ve Yeşilyurt, E. (2008). Öğretmenlerin öğretim araç-gereçlerini kullanım amaçları, Fırat Üniversitesi Sosyal Bilimler Dergisi, 18(2), 175-188

Küçükahmet, L.(2002). Öğretimde panlama ve değerlendirme, (13. Baskı), Ankara: Nobel Yayın Dağıtım

Milli Eğitim Bakanlığı, (MEB), (2005a). İlköğretim matematik dersi 1-5. sınıflar öğretim programı, Ankara: Devlet Kitapları Müdürlüğü

Milli Eğitim Bakanlığı, (MEB), (2005b). İlköğretim matematik dersi öğretim programı ve klavuzu 6-8. sınıflar, Ankara: Devlet Kitapları Müdürlüğü

Peker, M. ve Halat, E. (2008). İlköğretim I. kademe matematik programının eğitim durumları boyutunun öğretmen görüşleri doğrultusunda incelenmesi, Selçuk Üniversitesi Ahmet Keleşoğlu Eğitim Fakültesi Dergisi, 26, 209-225

Rüzgar, B. (2005). Bilginin eğitim teknolojilerinden yararlanarak eğitimde paylaşımı, The Turkish Online Journal of Educational Technology, TOJET, 4(3)

Tüy, M.A. (2002). Öğretim teknolojilerinin sistematik kullanımına ilişkin öğretmen davranışlarının çözümlenmesi, Yayınlanmamış Yüksek Lisans Tezi, Ankara Üniversitesi

Yalın, H.İ. (2004). Öğretim teknolojileri ve materyal geliştirme, Ankara: Nobel Yayın Dağıtım

Yıldırım, V. (2000). İlköğretim okulu beşinci sınıf öğretmenlerinin öğretim yöntemleri konusundaki görüşleri, Yayınlanmamış Yüksek Lisans Tezi, Fırat Üniversitesi Sosyal Bilimler Enstitüsü