

AN APPROACH TO DEVELOP PHYSICS STUDENT TEACHERS' SKILLS OF USING INSTRUCTIONAL TECHNOLOGY

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Abstract

It is very important to develop student teachers' skills and knowledge during the pre-service teacher education process. In this study, the effectiveness of the approach in which student teachers' gained the skills of developing and using Teacher Guided Materials (TGMs) based on integration of technology on physics education in Special Teaching Methods Course-II (STMC-II) for pre-service Physics teachers was evaluated. The study was conducted with 33 physics student teachers in KTU. Student teachers were required to develop and present TGMs, which were based on principles of special teaching approaches and techniques and integration of technology through instruction. The data of the study gained from semi-structured interviews conducted with 14 student teachers, observations of the lessons conducted by the each student teacher and document analysis of the student teachers' diaries collected during the term.

The student teachers stated that STMC-II was a very helpful experience to gain teaching skills. It is believed that these all activities, which are designed and performed in the classroom by student teachers during STMC-II course, will not only prepare them to their teaching but also help them to gain basic experiences that they will need in their future career. At the end of the process it is concluded that all of the student teachers gained nearly whole defined aims –skills and knowledge- of the STMC-II. The implementation process should be organized very well to have advance of gaining many skills together.

Key words: *Physics Student Teacher, Special Teaching Methods Course-II, The Skills of Developing Teacher Guide Materials and Integration of Technology.*

1. INTRODUCTION

Teacher education institutions are affected by recent technologic advances. They have tried to restructure their education programs and classroom facilities in order to train the teachers of future skillfully (Rizza, 2000; Devecioglu, 2004). This restructuring process requires integration of technology into existing context in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance professional productivity (Strudler&Wetzel, 1999; Tomei, 2005; Baslanti, 2006; Yaman, 2007).

One of the courses is Special Teaching Methods Course-II (STMC-II) to integrate technology into physics teaching to gain main teaching skills in pre-service teacher education programs (YOK, 1998). STMC-II has a crucial importance in terms of gaining pedagogical knowledge, skills and attitudes for student teachers. That course can be accepted as a kind of bridge to connect theoretical knowledge into practice. During that course student teachers are expected to gain experience on teaching practice. In this way they can enhance their main abilities and develop positive attitudes toward teaching. That course aims to train student teachers to know and apply contemporary teaching/learning principles to content teaching (Devecioglu, 2004; Devecioglu&Akdeniz, 2005; Devecioglu& Akdeniz, 2007; Devecioglu, Akdeniz&Ayvaci, 2007). This course is conducted on the ninth terms of physics teaching department in the faculty of education in Turkey. After process of content knowledge education for six terms, student teachers take pedagogical content

knowledge until the end of their fifth years. That course aims student teachers' pedagogical development by the working of all materials and documents for sustainable development (Karamustafaoglu, 2003; Devecioglu, 2004; Devecioglu& Akdeniz, 2006). During that course, student teachers as learners should be actively involved in the process to learn teaching. This active involvement aims at developing learners' attitudes and particularly their motivation towards teaching. One of the main characteristics of that course is that gaining the skills of using instructional technology (IT) during physics teaching (Devecioglu, 2004; Devecioglu& Akdeniz, 2007; Devecioglu&Akdeniz, 2008). Student teachers experience using technology during the applications of the course.

There are many studies on defining the profiles of the using computer and internet among student teachers-the effects of technology and using of technology during learning/teaching process and the development of student teachers' skills (Strudler&Wetzel, 1999; Bauer&Kenton, 2005; Toprakci, 2007; Yildirim, Nas&Ayas, 2007; Akbulut, 2008; Gulbahar, 2008). It is very important to use and integrate computer resources into classroom practices during instruction (Gos, 1996). However, there are not enough studies on defining of the level and success of integrating new technologies into pre-service teacher education programs.

Desiring technology-competent teachers for 21st century classrooms, we have to inquire the utilization of technology in teacher education institutions (Yildirim, 2000; Devecioglu, 2004; Yaman, 2007; Devecioglu&Akdeniz, 2008; Devecioglu&Yildirim, 2008). Given the importance of access to technology, technology-competency and effective integration of technology, an understanding of how instructors and pre-service teachers in a faculty of education perceive technology can help institutions of higher education to successfully integrate, in relation with the current ICT usage (Strudler&Wetzel, 1999). Understanding the factors contributing to the utilization of technology and the possible relations of these factors will lead us to educate technology-competent teachers. Under the light of these facts, the main purpose of this study was to examine factors that contribute to preservice teachers' utilization of technology and suggest recommendations regarding to the effective utilization of technology during physics teaching. This study contributes to draw an understanding of how student teachers can gain the skills of successfully integrating technology during the Applications of STMC-II.

2. Research questions

The main purpose of this study is to figure out the effectiveness of the approach implemented to gain the skills of developing and presenting teacher guide materials based on integration of technology into instruction process in STMC-II for physics student teachers in the Fatih Faculty of Education at Karadeniz Technical University in Trabzon-Turkey. This study specifically focuses on the following research questions: ➤ Is there an approach for student teachers to develop their skills to integrate technology as learning and teaching tool during STMC-II? ➤ What behaviors did student teachers develop during the course under the implemented approach? ➤ What kind of problems did they meet during their instruction with technology? ➤ What are student teachers' suggestions to gain the skills of integrating technology to physics teaching?

3. Methodology

Case study research design was used. STMC-II was conducted by scientific methods in pre-service physics teacher education program. This study offers a different approach to gain the skills of developing and using teacher guide materials which are used by student teachers during the course process. The sample of the research is 33 last-year (ninth terms) physics student teachers attending to Physics Teaching Department in the fall term of 2007-2008 academic years. The approach implemented from the beginning of the course was determined as following stages:

- ❖ High school physics subjects (units) were distributed among the groups of student teachers. These physics subjects were; force, current, energy, motion, heat and temperature, light, electrostatics, impulse and momentum, Newton's Motion Laws.
- ❖ Students were required to develop teacher guide materials, which were based on the principles of constructivist learning, different instructional techniques and integration of technology.
- ❖ Each group defined students' misconceptions on their own subjects.

❖ Each groups' materials were examined and feedbacks gave to enrich the effectiveness of these materials. During that course student teacher shared their ideas and explored the other studies and researches, technological developments and applications. Classroom discussions were conducted during the course about findings and studies of each group.

❖ Each student teacher presented their materials in one class hour. During the teaching practice in the classroom the presenter student teacher pretended as a real teacher and the other student teachers behaved as real students during this mini teaching in STMC-II. Student teachers had all opportunities to use computers, overhead projector, internet and projector during their mini teaching. The skills of using technology for professional development of physics student teachers are evaluated during that course.

4. Data Collection

The data of the study was obtained from interviews, semi-structured observation forms and document analysis of the teacher guide materials that were prepared by student teachers. Moreover, student teachers' diaries were examined. During the mini teaching practice student teachers were observed by a semi-structured observation form. They were evaluated in terms of using IT in their teaching. Their recorded behaviors were summarized. Interviews were conducted with 14 student teachers chosen randomly. Student teachers ideas about the implemented approach to gain the mentioned skills were defined by interviews. The student teachers answers were transcript and analyzed qualitatively. Document analysis was done to evaluate student teachers' materials and diaries in terms of using IT. According to document analysis of student teachers diaries the gained skills were summarized. In their diaries, they recorded their behaviors gained during that course and mini class teaching on STMC-II from beginning to the end of the course. The diaries were examined to find out their improvement on using of technology for physics teaching.

5. Findings

The data gained from the instruments were examined in terms of the effectiveness of the approach to gain the skills of developing and presenting teacher guide materials based on IT for physics student teachers.

5.1. The Data Gained From The Student Teachers' Interviews

The interviews' data were summarized on three items: the improvement of the student teachers, their problems they encountered during the implementations, and their suggestions on that circumstance.

According to data gained from interviews, the majority of the student teachers believed that using technology is very important for physics teaching. Some of the student teachers mentioned that using IT during instruction was more enjoyable and easy after learning to use in teaching. For instance, using online database, instructional software, electronic presentations and animation software facilitated their concept teaching. One of the student teachers said that he founded many online databases with animations to concrete and to illustrate the relationships between physics concepts. Half of the student teachers admitted that they were not very well during their mini teaching practice. Some of the student teachers thought that to prepare different teaching materials based on IT needs more time. Some of the student teachers stated that instead of preparing new teaching materials, such as worksheets, PowerPoint Presentations, animations, models etc., to use they preferred to use a prepared one on subject teaching. Besides, they stated that researching to find prepared materials from internet or library was gained them to explore various data sources. According to their ideas, they learned how to reach and arrange the information for their needs on their field. Particularly, all of the student teachers were agreed that they would develop their skills by the time and experience. According to their ideas, lack of confidence and understanding affected the student teachers attitudes during that integration process of IT into mini teaching practice. Nearly all of the student teachers recommended that these kinds of activities should be obligatory during pre-service teacher education. Otherwise, they could not do these kinds of activities and gain the skills. They thought that the approach implemented in STMC-II was very effective to gain main teaching skills and motivate them for teaching profession. Besides, some of the student teachers were agree on the idea that the

mini teaching was a good practice to manage a class and contributed to their skills development. Their attitudes were also positive using computer on their teaching. During STMC-II by the implemented approach, the student teachers had an opportunity to notice the importance and facilities of using IT's on physics teaching. Besides, the student teachers stated that they had gained high motivation and self-confidence for their future careers.

5.2. The Data Gained From Observations

According to the data of the observations, the student teachers mostly chose computer, overhead projector, projector, internet browsers and Web pages to use in their materials during mini teaching practice. However, some of the student teachers had opportunity to illustrate some physics subjects such as circuit, force and motion, heat and temperature by using Web pages and electronic presentations; they did not use and integrate technology as a teaching and learning tool.

At the beginning of the course it was very difficult for student teachers to use two or three teaching methods and materials together during their instruction. They usually preferred traditional teaching approaches. After the critiques and recommendations at the end of each mini instruction, student teachers tried to enhance their course time and developed more instructive materials for better teaching. One of the important findings is that student teachers are not successful enough to combine the skills gained from the other pedagogical courses. They lacks of experience using the knowledge integrating on practice. Some of the student teachers were incapable of developing and using worksheets, slides, power-point presentations for their instruction. Furthermore, they had problems while using these materials. While using one material, they forgot or were unable to pass throughout the other material. By the middle of the course nearly most of the student teachers started to use computer and overhead projector in their mini teaching. At the end of their mini teaching each student teachers were evaluated for their teaching on following points: * Organize transition of each materials and instructive actions effectively, * Keep in control class management, *Use the blackboard effectively,* Use worksheets, computer, overhead/projector, internet, animation software,* Use attractive materials for students' interests,* Use different teaching methods such as brainstorming, concept map etc...

5.3. The Data Gained From Document Analysis

Student teachers' materials evaluated in terms of using various I.T. Most of their materials were acceptable to have variation on paper. It is found that they were more successful on paper than their mini teaching practice. The examinations of the student teachers' diaries showed that at the beginning of the course, they had written the following behaviors, such as; ✓ Searching for developing different teaching materials, ✓ Noticing the importance of using various materials in physics teaching, ✓ Searching for student misconceptions on definite physics subjects etc...

It was observed that in time, the number of the student teachers' written behaviors increased. Some of the mentioned behaviors as following such as;

✓ Understanding the importance of using IT in physics teaching, ✓ Observing varied teaching practices by using various teaching methods together, ✓ Using blackboard effectively, ✓ Integrating technology into physics teaching, ✓ Using internet databases to illustrate physics concepts etc...

6. Conclusions/Implications

It is a fact that professional development of physics student teachers is very crucial in pre-service teacher education (Brooks&Sikes, 1997). They should gain the skills of integrating theory into practice on main teaching competencies (Knapper, 2001; Yaman, 2007). The findings of this study showed that during the STMC-II, the activities aiming to help student teachers to develop, gain, and measure the desired behaviors were mostly achieved. STMC-II and the implemented approach were very effective on gaining the skills of developing and using teacher guide materials based on integration of technology into teaching and improving pedagogical development of the physics student teachers. It is believed that the activities, which were designed and performed in classroom by teacher candidates in STMC-II, would not only prepare them to their teaching but also help them to gain basic experiences that they will need in their future career. The implementations contributed to student teachers' utilization of IT. At the end of the course, it is concluded that they gained the skills as following:

- ❖ Prepare and implement learning materials according to constructivist learning principles,
- ❖ Choosing the appropriate teaching methods for the physics subject,
- ❖ Using different teaching techniques together on both preparing and presenting teaching materials,
- ❖ Integration of technology in physics learning/teaching,
- ❖ Developing materials and implementing these materials during instruction,
- ❖ Determining students' misconceptions on physics subjects,
- ❖ Developing content and pedagogical content knowledge, attitude and interest,
- ❖ Motivating her/himself through teaching,
- ❖ Evaluating him/herself about the mini teaching practice on the course...

The results obtained through this study showed that teaching materials prepared according to constructivist learning principles by student teachers increased their academic success, skills and attitudes toward teaching profession. The student teachers stated that they developed their content and pedagogical content knowledge on physics education, attitude and interests towards teaching profession. These results showed that the course and the implemented approach were very effective on the improvement of the physics student teachers. Usage of content and pedagogical content knowledge together with contemporary teaching approaches forced the student teachers to be more active on developing teaching skills on physics teaching. These results showed that the course and the implemented approach were very effective on the improvement of the physics student teachers (Devecioglu, 2004; Devecioglu&Akdeniz, 2007). Moreover, the approach was very affirmative experience for them before Teaching Practice. Thus they felt self-confidence for further studies (Chen, 1986; Hunt&Bohlin, 1993; Arnez&Lee, 1990; Levine&Donitsa-Schmidt, 1998; Yaman, 2007).

On the other side, there was a limitation for the student teachers that they usually preferred to use prepared teaching materials for example web-based animations, PowerPoint Presentations. In this case, they could not improve their existing behaviors and skills on planning and developing technology-based instructional materials. It can be said that they were able to present their founded teaching materials.

This kind of implementations will promote the development and dissemination of theoretical knowledge and professional practice knowledge on physics education and integration of technology into education. It is a real that successful integration of technology into teaching requires not only the knowledge on technology and its potential but also the skills to plan and implement a good teaching. At the end of the paper there is a model for future studies to gain the skills of developing and using materials based on IT for student teachers in physics teaching. In order to maintain student teachers' pedagogical development contemporary teaching/learning strategies should be implemented. According to that model student teachers should focus intensively on material development through concept teaching. There are the steps of the model to follow during STMC-II;

- Firstly, the goals of the course should be defined.
- Student teachers should be informed about these goals aimed to gain main teaching characteristics.
- It is definitely emphasized that student teachers should direct to develop different materials.
- Feedback is very important to enrich their skills during that course.
- Student teachers should be able to connect theoretical and practical knowledge together. Thus they can improve themselves on teaching.
- In order to develop their practical knowledge and motivation, strategies and instructional programs should be organized effectively. They should be directed and trained to implement more teaching practice on real classes.

Consequently, it is thought that this kind of implementations should be discussed between education authorities for better implementations for pre-service teacher education. The implemented approach could be revised again and developed to gain more skills of integrating technology into physics teaching. In order to gain the skills of using IT in teaching practice, physics student teachers should improve their exist skills fairly good. Education institutions should train teachers who are technology-competent and effectively use and integrate technology into their teaching activities.

7. References

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