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First steps in educational research: the views of Turkish chemistry and biology student teachers

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This qualitative study examined student teachers' views on the value of undertaking small-scale research as part of the secondary teacher training course, and evaluated quality of the research reports prepared by the student teachers in terms of meeting the methodological requirements. Data was gathered by a questionnaire composed of open-ended question and completed by 76 chemistry and biology student teachers, semi-structured interviews were done with 11 of those who completed the questionnaire and 14 research reports was analysed. The results indicate that student teachers valued small-scale research project as a learning activity, and gained significant knowledge of research methodology as well as the title/concepts they studied and problem solving skills. Most saw research as offering the potential to provide valuable insights into teaching and learning.

Cette étude qualitative vise à analyser les opinions des candidats-maîtres en secondaire sur la valeur d'une recherche à une petite échelle et à évaluer du point de vue de la méthodologie la conformité aux critères du rapport de recherche préparé par les candidats-maîtres. Les données ont été obtenues par un questionnaire composé des questions ouvertes-fermées, rempli par 76 candidats-maîtres dans le domaine de la chimie et de la biologie, par une analyse des interviews semi-structurés réalisées avec 11 étudiants choisis parmi 76 et celle de 14 rapports de recherches préparés par les candidats. Les résultats révèlent que les candidats-maîtres considèrent une recherche à une petite échelle comme profitable et qu'ils apprennent à maîtriser à la fois la méthodologie et le thème/le concept recherché et qu'ils améliorent ainsi leur capacité de résoudre un problème. La majorité des participants se mettent d'accord sur l'utilité des recherches à effectuer par les candidats pour leur apprentissage.

Las opiniones de este estudio cualitativo profesores examinados del estudiante sobre el valor de emprender la investigación en reducida escala como parte del curso de aprendizaje secundario de profesor, y calidad evaluada de los informes de la investigación se prepararon por los profesores del estudiante en términos de resolver los requisitos metodológicos. Los datos fueron recopilados por un cuestionario integrado por la pregunta ampliable y terminado por 76 química y profesores del estudiante de la biología, las entrevistas semi-estructuradas fueron hechas con 11 de los que terminaron el cuestionario y 14 informes de la investigación eran analizados. Los resultados indican que los profesores del estudiante valoraron proyecto de investigación en reducida escala

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como actividad que aprendía, y conocimiento significativo ganado de la metodología de la investigación así como el title/concepts ellos estudiaron y las habilidades el solucionar de problema. La mayoría vieron la investigación como ofrecimiento del potencial de proporcionar penetraciones valiosas en la enseñanza y aprender.

In dieser qualitativen Arbeit werden die Ansichten der Kursteilnehmerlehrer über den Wert des Unternehmens der kleinräumigen Forschung als Teil der Sekundärausbildung der Lehrer-kursieren überprüft und die vorbereitete Qualität der Forschung-Reports wird von den Kursteilnehmerlehrern in dem Entsprechen der methodologischen Anforderungen ausgewertet. Die Daten wurden durch einen Fragebogen erfasst durchgeführt, der aus offener Frage bestand und von 76 Chemie- und den Biologiekursteilnehmerlehrern verwendet wurde, 11 davon waren in halb-strukturierten Interviews erfolgt, die den Fragebogen durchführten und 14 Forschung Reports wurden analysiert. Die Resultate zeigen an, dass die Kursteilnehmerlehrer das Projekt für kleinröumige Forschung für vorteilig halten und dadurch sie sowohl Methodenlehre für Forschung als wie Thema/Begriff Verhältnis erlernen. Sie drücken aus, daß sie fähig gewesen sind, dadurch die Probleme zu lösen. Die meisten verstanden, dass wissenschaftliche Forschung zum Erlernen und Lehren großen Beitrag leisten.

Introduction

Educational researchers and teachers share the common aim of wanting to improve teaching and learning in science (Bennett & Campbell, 2002). Interest in how to make teachers more responsive to research findings is currently attracting the attention of scholars around the world (Everton, Galton & Pell, 2000; Counsel *et al.*, 2000; Cochran-Smith, 2003). One of the key issues in this debate has been the extent to which the purposes of carrying out research in education should be chiefly directed towards school improvement in general and, in particular, towards facilitating effective classroom practice. It is believed that education, like medicine, should be an 'evidence-based' profession in which research findings are used by teachers in ways which take into account the varying contexts in which different schools operate (Everton, Galton & Pell, 2000). Useful research for teacher education would therefore clearly be about teaching and learning in schools, and would concern quality and effectiveness in the work of teachers (Hagger & McIntyre, 2000). Recent trends in educational research have sent ripples throughout the educational community including the field of teacher education. No longer is educational research used only as a way to prescribe pre-service and practising teachers' actions. Historically, getting teachers to read and follow research findings was a major priority of many teacher education programmes. However, today, assessing research, as well as becoming researchers by participating in some form of action research, is fast becoming a central focus of many programmes (Gitlin *et al.*, 1999). This is because, in recent years, reflective and action research have become a major theme in secondary programmes. For example, Pekarek *et al.* (1996) recommended that science teacher preparation and professional development programmes should encourage teachers to become researchers.

The concept of teachers as researchers is not new. Research carried out by teachers defined as 'a process of actively engaging teachers in the reflective

investigation and critical evaluation of their own practice' (Stenhouse, 1975) and called *teacher research* by Cochran-Smith and Lytle (1990). Teacher research includes a variety of action research approaches that differ in terms of teacher roles and research purposes (Henson, 2001). Richardson (1994) characterised much of the teacher research as practical inquiry and defined as 'conducted by practitioners to help them understand their contexts, practices, and, in the case of teachers, their students. The outcome of the inquiry may be a change in practice, or it may be enhanced understanding' (p. 7).

Why should teachers become researchers? It was argued by Van Zee (1998) that teachers might be influenced to change their practices more readily by reading reports of research by other teachers rather than by university researchers. Questions asked and findings reported by teachers might make more sense to other teachers and be more directly applicable to classroom contexts than research conducted by university researchers. In addition, teachers who participate as colleagues, rather than as subjects, in projects with university researchers can provide practical guidance in an investigation.

Despite recent calls for encouraging stronger links through 'evidence-based', 'evidence-informed' or 'reflective' practice (see for example Cordingley, 1999 and Millar *et al.*, 2002), the reality is that busy teachers have little time to devote to accessing research and are unlikely to draw on the findings unless they appear to offer something of direct value to immediate day-to-day concerns in the classroom. However, for the majority of teachers, the only time they are ever likely to encounter ideas about educational research in any kind of systematic way is during their teacher training courses (Bennett & Campbell, 2002). Beyond this point, there are limited possibilities of doing or taking part in educational research. Therefore, teacher training courses could be considered one of the best places to invite teachers into the educational research area. It was asserted that, for several reasons, teacher training courses should include educational research at some point (Counsell *et al.*, 2000). One of these reasons is that

> expert practice in teaching depends in critical ways on its context. Therefore, use of research either to improve or to justify one's practice is not a simple matter of adopting good externally generated ideas. Questioning one's individual practice in the light of these ideas, whether to improve it or to demonstrate its quality, depends upon teachers themselves being able to engage to some extent in the process of research, in order to have reliable grounds on which to judge the differential implications and consequences of their own new or established practices. (p. 468).

Therefore, it could be claimed that teachers at least begin to learn to make use of educational research in their training stages.

There are several studies focussed on teacher research and trainee teachers involved in educational research. Among those Everton, Galton and Pell (2000) surveyed teachers' views of research and noted that few of the teachers surveyed referred to any recent research studies. They argue that it is important that teachers are again given extended opportunities for further professional development, working alongside active researchers. The study also suggests that younger teachers

were willing to engage both with and in research, which would have a direct impact on classroom practice. Henson (2001) has investigated improvement of motivational factors such as self-efficacy, empowerment, collaboration and perceptions of school climate of teachers who participated in teacher research. The results showed that both general and personal teaching efficacies showed large average gains across time, however both empowerment and school climate showed little improvement and collaboration exhibited a moderate gain. It was suggested that teacher research may be a particularly powerful method of professional development that can impact teacher efficacy and actively engages teachers in instructional improvement concerning issues relevant to the teachers. The study also suggests further studies looking at potential implications of teacher research models on pre-service teacher education. In a small-scale research project based on qualitative approaches by Campbell and Jacques (2004) the effect of teacher research on teachers' professional developments were studied. Nineteen teachers were involved and the results suggest that teachers as enquirers in their classrooms and as disseminaters of their findings could provide opportunities for individualised, bespoke professional developments.

Research on pre-service teachers involved in educational research has started to be an emerging area of educational research. Gitlin *et al.* (1999) studied pre-service teachers' thinking on educational research and concluded that the incorporation of action research into initial teacher education programmes could help develop a better understanding of research as a form of educational enquiry. Van Zee (1998) carried out an interpretive study that involved documenting and reflecting upon ways in which the prospective teachers were engaged in doing research. The study argues that an action research approach in teacher training courses would help student teachers to identify, examine, and refine their ideas, beliefs and values about science teaching and learning. A study carried out by Brinkman and Van Rens (1999) examined student teachers' experiences in performing a research project as part of their curriculum. They concluded that most of the problems experienced by student teachers fall back on how to formulate searchable research questions. They suggested considering a structurally guided pilot study comprising several research activities, especially the formulation of searchable question, should be conducted by student teachers in order to tackle the problem of formulating research questions. In a recent study, in which student teachers undertook small-scale research projects, Bennett and Campbell (2002) investigated student teachers' views on the value of educational research. The results of the study provide positive attitudes about inclusion of research projects into teacher training courses. The results are encouraging from different perspectives. Firstly, student teachers value the importance of doing research prior to teaching in order to be reflective practitioners. Secondly, many student teachers appreciated the gained research skills and considered engaging further research in their future life. If it was expected that science teachers are to take note of research findings and, particularly, for some of them to be practitioner researchers, opportunities for student teachers to gain experience of actually doing educational research should be created.

In recent years, the nature and the purposes of educational research have begun to change. Understanding educational research as a scientific approach that helps distinguish subjective impression from facts is moving towards a view of research that includes an interpretive process based on observations, interviews, questionnaires that enable the researcher to draw some context bound subjective conclusions about education and schooling. The purpose of research has expanded beyond fact finding to include reflective inquiry. The problem of getting research to practitioners no longer dominates the landscape. Instead, there is a growing focus on enabling practitioners to engage in research (Gitlin *et al.*, 1999). In this manner, inclusion of some kind of research practices into teacher training courses is getting considerable attention. This situation has prompted the researcher to explore ways in which new entrants to the profession might be introduced to ideas about educational research and gain experience of some of the ways in which it might contribute to reflective practice. One outcome of this exploration was the introduction of a small-scale research project into secondary teacher training course. It is important to assess the effectiveness of this course and student teachers' views of value of such an inclusion.

Aim of the study

Kazım Karabekir Education Faculty at Atatürk University provides one and a half year long (three semesters) postgraduate teacher training courses, qualifying, for example, chemistry, physics, biology or mathematics graduates for teaching in secondary schools (aged 14–17). Part of the curriculum is an individual research project which has an open character: student teachers formulate their own field of interest and the research question to address. Projects are problem-oriented and have mixed characters ranging from quantitative to qualitative approaches. However, most of the research projects, at least in chemistry and biology, address pupils' learning problems, aiming to investigate how pupils acquire knowledge.

Having supervised a number of these projects over the past few years, the author of this article has come to realise that student teachers have some concerns about the projects. Therefore, the study reported in this article has two aims. These are:

- to gather student teachers' views on the value of undertaking small-scale research as part of the secondary teacher training course
- to evaluate the quality of the research reports prepared by the student teachers in terms of meeting the methodological requirements.

Research method

The present study employed qualitative methodologies in order to achieve the aims described above. Data was collected from 38 (out of 40) chemistry and 38 (out of 42) biology student teachers enrolled to the Master without Thesis (a master programme without thesis, similar to PGCE in UK) programme at Kazım Karabekir Education Faculty of Atatürk University in Turkey during 2004–2005 academic year. Participation in the study was voluntary and only two chemistry and four

biology student teachers did not volunteer to join the study. Therefore, they were omitted. The Master without Thesis programme requires completion of graduate courses and a small-scale research project. It is a one and a half year long (three semesters) postgraduate teacher training programme, qualifying, for example, chemistry, physics, biology or mathematics graduates for teaching in secondary schools (aged 14–17). The small-scale research project aims to provide student teachers with the knowledge and skills to design, carry out and report on a small-scale research study which links their reading and understanding to their classroom, and to encourage student teachers to value the contributions educational research can make to improving classroom practice and students' learning. There were no main criteria used in selecting areas for inclusion as topics for a small-scale research project. The topics chosen for study were purely dependent on the student teachers and their supervisors. The student teachers are provided with a pack of materials, presented as a supported self-study unit, to guide and inform the study they carry out for the small-scale research project. The work is undertaken over a 14-week period. In addition, chemistry student teachers are taught for the first three weeks (total of 9 hours) about basic educational research methodology by one of the supervisors, the student teachers in biology received educational research methodology instruction by their group supervisors. The planning stage is left to the supervisors. At the time of data collection students had completed their small-scale research projects.

Data was collected through three different instruments. A questionnaire composed of 6 open-ended questions was developed on the basis of questions used by Bennett and Campbell (2002). Some of their questions were modified and some new questions were added. The questionnaire is given in Appendix 1. The questionnaire was administered to total of 76 student teachers who completed their small-scale research project. Based on the initial coding of the questionnaires, dominant themes based on frequency of responses were identified. These patterns and themes articulated how these student teachers viewed research and educational research, and the value of undertaking small-scale research as part of the secondary teacher training course, but did not provide in-depth explanation of their personal views in some questions. To address this limitation, 11 students (6 chemistry and 5 biology) were interviewed. Semi-structure interviews with each of these students using the questionnaire as a guide while adding probe questions that encouraged students to elaborate and clarify their responses. All interviews were tape recorded by taking interviewee's consent and transcribed for analysis.

In addition to these instruments, a document analysis of research reports prepared by the 6 chemistry and 8 biology prospective teachers was done. The following stages were followed in selection of the research reports. There are six and eight supervisors in the chemistry and biology teacher training departments respectively responsible from the small-scale research projects. Each supervised about 5 to 7 student teachers. Only one of the student teachers' research reports was selected randomly from each supervisor group to analyse. The document analysis was done on the basis of the criteria, a research report has to follow, presented to the students

at the beginning of the project. The criteria for document analysis are given in Appendix 2. All 14 research reports selected were read through and checked to determine whether the particular criteria were addressed or not. In order to ensure the reliability of document analysis, the researcher has done the analysis twice with a two-week interval. The results indicated over 95% agreement. Inconsistencies found were reconsidered.

To analyse the questionnaire, all student responses were read and themes were determined. Then a sample of 20 students' responses was tallied by the researcher and two other colleagues in order to ensure the reliability of coding. The results of independent coding indicated a high agreement between the researchers. Modifications were made where there were disagreements. Then, all responses were tallied in order to determine the frequency of themes.

Interview data was analysed with the themes identified in response to questionnaires in mind, but frequencies were not determined as the interview data was only used in order to support the questionnaire data. As the questionnaire writings and interviews were conducted in Turkish language, the quotations reported in the paper were translated into English.

Results

The first research question concerned student teachers' views on the value of undertaking small-scale research as part of the secondary teacher training course. Table 1 shows the analysis of student teachers' responses given to the questionnaire. In table 1, the views are inserted if it was asserted by more than 10 percent of the respondents in any of the participating groups. Some views asserted by the chemistry student teachers were not shared by the biology group and therefore they were shown as zero in the table.

The results are presented question by question and discussed.

Q1. What were the most and least valuable aspects of the study?

As seen from Table 1, the most common view was that the small-scale research project helped student teachers to learn research methodology. This view was asserted by 42 and 76 percent of chemistry and biology student teachers respectively. A typical response was:

> The most beneficial aspect was firstly I have learned how a research is done. We have had knowledge of benefits and difficulties of research. In addition, we have learned by experience about important aspects of research that should be taken into consideration. [chemistry-questionnaire].

> The most beneficial side was that I have learned how to do a scientific research and report it. I cannot see any valueless side of doing such a project but, it took quite a lot of my time. [biology-questionnaire].

The above excerpts suggest significant evidence that these projects are achieving one of the most important aims of the course, that of helping student teachers to learn how to do educational research.

Table 1. Analysis of student teachers' responses to the questionnaire.

Category	Frequency (%)	
	Chemistry (n=38)	Biology (n=38)
Q1. What were the most and least valuable aspects of the study?		
I have learned research methodology	16 (42)	29 (76)
I have realised my lack of knowledge about the title/concept I studied and revised my knowledge	22 (58)	3 (8)
I have realised how important the concepts in effective teaching and I have had knowledge about how to overcome misconceptions.	7 (18)	–
My knowledge of educational issues is improved	6 (16)	–
My reasoning skills are improved	1 (3)	4 (11)
Q2. How might you use the knowledge and skills gained?		
I might use the knowledge I gained in teaching concepts meaningfully in future	14 (37)	–
I might use the knowledge I gained for doing research in postgraduate education	2 (5)	9 (24)
I might use the knowledge I gained in using different methods in teaching	8 (21)	3 (8)
I might use the knowledge I gained in doing research on my own	4 (11)	8 (21)
I might use the knowledge I gained in solving problems which I would come across	3 (8)	7 (18)
Q3. What are your views on the appropriateness of this type of assignment at this stage of a Master without Thesis course?		
Appropriate	24 (63)	20 (53)
Appropriate, but there are some problems in the process (time restriction, title of the project and inconsistent approaches between supervisors)	12 (32)	8 (21)
Inappropriate, because it takes too much time	2 (5)	6 (16)
Q4. How has carrying out the assignment influenced your views of use of educational research in teaching practice?		
In general, I could do better teaching	10 (26)	21 (55)
I have studied misconceptions, therefore I could easily identify students' misconceptions during teaching	17 (45)	–
I could transfer the skills I gained about acquiring knowledge to my students	4 (11)	6 (16)
I could apply the knowledge I gained about different teaching approaches into classroom	5 (13)	–
I don't think I could use the knowledge I gained, because the results have lack of reliability	1 (3)	5 (13)
Q5. What are your views on the value of teachers carrying out educational research?		
Teachers will be aware from the new developments in education and they refresh their knowledge	13 (34)	16 (42)
It will be beneficial in terms of determining problems encountered in education systems	13 (34)	5 (13)

Table 1. (*Continued.*)

Category	Frequency (%)	
	Chemistry (n=38)	Biology (n=38)
Teachers will be aware of their deficiencies	11 (29)	4 (11)
They will better understand their students' learning	5 (13)	2 (5)
Q6. Having done your research projects, and had an opportunity to find out what others hove done what (if any) research might you like to do when you become a teacher?		
I would do research on diagnosing students' misconceptions and overcoming them	13 (34)	–
I would do research on how to teach different topics effectively with different teaching approaches	9 (24)	12 (32)
I would do research on how to increase students' motivation towards my course	4 (11)	3 (8)
I would do personal development projects	1 (3)	4 (11)

The 'least valuable' aspects were interpreted as the limitations of the study such as time restriction and practical problems in having access to schools. As these views were less than 10% they were not included in Table 1. However, typical responses were 'it took more than that I planned', 'I had to spend a lot of time and money', 'it requires quite an effort', 'we had to beg to teachers to do questionnaire in their classrooms'.

The second most common view was that this project based study helped the student teachers to realise their lack of knowledge about the title/concept they studied and revised their knowledge. This view was widely expressed by chemistry student teachers (58%) since studying students' misconceptions was one of the most popular among them, and also 8% of biology student teachers. Typical responses were as follows:

> The most beneficial aspect is that I have realised how weak I was in the title I have studied. I have realised my misconceptions and I think, I have corrected them. [chemistry-questionnaire].

> I have learned the title I have studied. I have also learned how to do literature search at library and on internet and how to get academic papers… [chemistry-questionnaire].

> Firstly, it was beneficial as I had to learn very well the title I studied… [chemistry-questionnaire].

In conjunction with the above notion, the third common view which was only voiced by 18% of chemistry student teachers that 'I have realised how important the concepts in effective teaching and I have had knowledge about how to overcome misconceptions'. This view is consistent with the above notion. However, it is important to notice, although more than half of the chemistry student teachers realised how widespread misconceptions are among student teachers and

themselves, only 18% of them have learned, or at least considered, how to overcome them. This result perhaps provides an important indication to the supervisors how future research projects could have been designed. The research projects could be designed in such a way that student teachers who will study students' misconception deal both with identifying misconceptions and work on how to overcome them.

The following two views, such as 'my knowledge of educational issues is improved' and 'my reasoning skills are improved', were expressed by less than 20% of the student teachers. Some responses included views such as; 'I have realised how widespread educational problems encountered in schools and I have learned more about educational issues as I had to read quite a lot', [biology-questionnaire]; 'I haven't done such a study so far. I think that it improved my reasoning skills', [chemistry-questionnaire]. Data gathered through interviews provided similar results with the questionnaire data.

Q2. How might you use the knowledge and skills gained?

Comments were made about knowledge gained from specific projects, and the more general use of research skills. As seen from Table 1, the most common comment was that 'I might use the knowledge I gained in teaching concepts meaningfully in future' which was identified among 37% of chemistry student. The following excerpt reflects this view:

> As misconceptions are so common, when I become a teacher, I will pay much attention to prevent them, and try to teach concepts in a way that students understand better. [chemistry-questionnaire].

The second common view which was particularly asserted by biology student teachers (24%) that the knowledge gained might be used for doing research in postgraduate education. Those who shared this view mainly focused on the methodological skills gained and ignored the subject knowledge. The following quotations support this view:

> If I become academician, and do further research I will benefit a lot. [biology-questionnaire].

> I am planning to do post-graduate study in the future and the knowledge I gained here will help me quite a lot. [biology-questionnaire].

In addition to the above view, 11% of chemistry and 21% of biology student teachers commented that the knowledge gained might be used in doing research on their own. This is quite encouraging in terms of reaching the ultimate aim of educating future teachers as reflective practitioners in their classrooms. Moreover, almost one fifth of student teachers thought that the knowledge gained from this small-scale research project might be used in applying different methods in teaching. This view was mostly expressed by the student teachers who have done research on effects of new teaching approaches, such as problem-based learning and conceptual change approaches, on students' learning. This could be seen at the following excerpt:

> I could use the knowledge gained from my project in classroom when I become a teacher. I think I will be successful if I apply the knowledge of problem-based learning into classroom. I will try to apply PBL into classroom accordingly, [chemistry-questionnaire].

Finally, the point raised by student teachers provides another encouraging indication that 'I might use the knowledge I gained in solving problems which I would come across' which were raised by 18% of biology and 8% of chemistry student teachers.

Q3. What are your views on the appropriateness of this type of assignment at this stage of a Master without Thesis course?

Overall, as seen from Table 1, the task was felt to be of considerably value. An overwhelming percentage of student teachers displayed their view supporting this small-scale research project. More than half of the student teachers (63% and 53% for chemistry and biology respectively) viewed the task as appropriate. The quotations below taken from student writings reflect typical views:

> It is, of course, appropriate and increases the quality of teacher training. These kinds of project-based works would help prospective teachers to learn how to do research and how to get the knowledge required. Teacher candidates would see students' difficulties and think about how to overcome them. Thus, they won't do the same mistakes as previous teacher did, therefore the quality of teaching increases, [chemistry-questionnaire].

> I think it is appropriate, because we have gained, at least, self-confidence through such a task. Also, we could do such kinds of researcher in the future by ourselves, [biology-questionnaire].

In addition, a quarter of the student teachers (32% and 21% of chemistry and biology respectively) viewed the task as appropriate but paid attention to some of the problems associated with the process. The most common problems encountered with the process were about time restriction, title of the project, student teachers' computer skills and inconsistent approaches between supervisors. Each supervisor has different experience and background in research. The majority of the lecturers in education faculty have a pure scientific research background rather than educational research. Education faculties in Turkish universities have been under a major revision since 1998. Most of education faculties employed scientist as lecturers due to a lack of people who have qualifications in subject education areas such as science education, chemistry education, biology education etc. Therefore, the lecturers' skills in science education research are not as good as it is in related scientific subjects they studied. Only, in recent years, lecturers who studied subject education, such as chemistry education, biology education in their doctoral studies started to be employed by the education faculties. Therefore, there is a shortage of lecturers who could provide supervision to student teacher to carry out these small-scale research projects and thus, the department had to appoint supervisors who have pure scientific research background. Therefore, some of those supervisors encourage

student teachers to do their project in areas close to supervisors' research background. In addition, while some of the supervisors give great importance to these small-scale research projects, some did not pay enough attention and did not provide adequate supervising. This created disturbances between the student teachers. Moreover, the time and effort required to complete the task was seen as a source of discomfort for the student teachers. Only two of chemistry and six of biology student teachers were opposed to such a task as it takes too much of their time. An interview carried out with one of those who was against provides some evidence on why student teachers opposed this kind of project:

> **R**[1]**:** Could you please tell me, why you think these kinds of small-scale research projects are inappropriate for secondary teacher training programmes?
>
> **I:** The main reason I opposed is that it takes our time. When we graduated from here we have to take KPSS exam (a qualification examination for first-time teachers). We will be asked about several different subjects in the exam. This kind of tasks [meaning small-scale research projects] take too much time, therefore we can't prepare for the exam.
>
> **R:** I see, you worry about the exam.
>
> **I:** Yes, in fact, what we have learned in this course [meaning small-scale research projects] is useful. I agree that every teacher should know how to do research, however, if we cannot be teachers where are we going to use the knowledge we gained? That is why I am opposed. Otherwise, it is good.
>
> **R:** What would you suggest we do to prevent your worries? What could we do?
>
> **I:** eem, perhaps some projects which don't take too much time…
>
> **R:** What [do] you mean, could you explain [a] little bit more?
>
> **I:** eem, for example, projects like literature review, critical analysis of research done. I can't think any more, [interview-chemistry]

As seen from the above dialogue, student teachers, in fact, are not against the task, however, they have worries about KPSS exam, which every student teacher has to take and be successful to be a qualified teacher. It is quite a competitive exam as there is a limited number of places in the secondary state schools. Only 5% of newly qualified chemistry and biology teachers could get a place at state schools. Although there are job opportunities in the private sector, most people prefer state schools as there is a job guarantee. Perhaps this figure best explains the stress student teachers experience. In addition, interview data provided results suggesting that this kind of project-based works should be started in the previous years of teacher training instead of doing it extensively in the final year, as their final year is too stressful. Some of them suggested that project work could be distributed in time as seen below:

> **R:** Could you please tell me, what do you think about the appropriateness of this type of assignment at this stage of a Master without Thesis course?

> **I:** I definitely think these kinds of projects are appropriate and useful. However, I have some questions in mind. Why was this project left to the final year? Couldn't [it] be done in previous years?
>
> **R:** What [do] you mean? How could it be done do you think?
>
> **I:** In my view, it could be started in the previous years of teacher training. At least, two semesters could be given to complete the task. One semester is not enough for such tasks. It requires too much time and effort.

Q4. How has carrying out the assignment influenced your views of use of educational research in teaching practice?

A variety of views were expressed which can be divided into two groups. The first group of responses expressed, in general, that it could be used in better teaching which was expressed by half of the biology and a quarter of chemistry student teachers. Following responses exemplify the case:

> We could improve [the] teaching environment, and use research findings for better teaching, [biology-questionnaire].
>
> I think, educational research could be used in teaching but I could not think of any specific points, [biology-questionnaire].

The second group of views suggested specific implications for teaching. The most common implication suggested was that ability developed in identifying students' misconceptions during teaching. This was expressed by almost half (45%) of the chemistry student teachers. Other views were about transferring the skills gained about acquiring knowledge to students and applications of different teaching approaches into classroom. A few of the student teachers were concerned about the use of the results of educational research they did in teaching, since their results lack reliability. The student teachers who expressed this view focussed mainly on the results of their study rather than the skills and knowledge gained through carrying out the task. Regarding question 4, interview results supported the views expressed in questionnaires.

Q5. What are your views on the value of teachers carrying out educational research?

Research undertaken by teachers was seen as an important issue by the student teachers and a significant percentage (34% and 42 % chemistry and biology respectively) of the student teachers felt that teachers will be better aware of the new developments in education and refresh their knowledge:

> It is necessary so that teachers particularly will be aware of recent developments in science and educational research area. They will update their knowledge by doing research projects. They will read more about academic writings, [biology-questionnaire].

A significant number (34%) of chemistry student teachers saw teacher research as the way to determine the problems encountered in educational systems:

> Doing research, as I said [above], teaches quite a lot. Teachers gather information about the problems, and how they could be solved. The quality of education will improve through teacher research, [chemistry-questionnaire].

In addition to the views given above, there were two different views that 'teachers will be aware of their deficiencies' and 'they will understand their students' 'learning' better. However, only two student teachers argued that teachers do not need to do research, as it takes too much of their time. Instead they would read the results of research made by others and reflect them in classroom practice. This view is further proved through interviews. All of the interviewees, except two, supported their view presented in questionnaires. They argued that reading research and doing research is not the same. The following dialogue exemplifies typical views:

> **R:** Could you please give me your views on the value of teachers carrying out educational research?
>
> **I:** My view is that a teacher would definitely benefit from doing research. Doing research will help teachers on different aspects such as improving themselves, seeing their weaknesses, learning about new developments in education, and aiming at least for meaningful learning.
>
> **R:** I see, what you mean. I am also wondering what you think about such a view that teachers do not need to spend their time to do research; instead they could read the research done by others and apply their results into classroom.
>
> **I:** … it seems right at first, but I am not sure how effective would be reading research. I don't think this will be an ultimate approach. As far as I see in schools, teachers do not read. They won't even read research reports, but if they are forced or participate in a way to the research, they will learn new things and it will be easy to apply it to the classroom.
>
> **R:** You support the view that teachers should do research? Am I right?
>
> **I:** Yes, [interview-biology]

Opposed to the above view, two student teachers who argued against the above view took the point that doing research is time-consuming as well as requires professionalism. The following dialogue was taken from an interview done by one of the student teachers:

> **R:** Could you please tell me about your views on the value of teachers carrying out educational research?
>
> **I:** Doing research does not suit teachers. Currently, every teacher has 20 to 35 hours of teaching duty at schools. How will they do research in these circumstances? Unless they find time to do research, again how will they do research? I don't think teachers are aware of research methodology. We have just done a piece of small research. I have seen how difficult it is. It requires a lot of knowledge of methodology… You need to know your subject very well. This is not enough, you need [to] know [how to] use the

> computer and the Internet, in addition, [on] top of all, you need to know how to do research.
>
> **R:** It seems to me that you are not agreeing with your classmates.
>
> **I:** I am talking about realities, not fantasies. In our country, I have seen the reality in schools. If teachers' conditions improved we could think again, but in these circumstances, I don't think it would be true. If teachers do research like we did, I would never trust their results. Research should be done by professionals, [interview-chemistry].

The above discussion suggests that those who are against doing research consider their circumstances at work, perhaps more realistically thus oppose teacher research. In addition, they are concerned about the reliability of the research findings. In their views, research is something that should be done more professionally.

Q6. Having done your research projects, and had an opportunity to find out what others have done what (if any) research might you like to do when you become a teacher?

Student teachers' views about this question showed quite a range of variety (see Table 1). Most of them made suggestions similar to theirs and [their] friends' research projects. Among those suggestions, research on diagnosing students' misconceptions and overcoming them, how to teach different topics effectively with different teaching approaches, research on how to increase students' motivation and personal development projects were most popular. However, few of them preferred not to do research in future, at least at the beginning of their teaching career due to worries about time management as quoted below:

> I don't think I will have time to do research at the beginning of my teaching career. I could only cope with my teaching workload, [chemistry-questionnaire].

Analysis of research reports

The second research question is concerned with evaluating the quality of the research reports prepared by the student teachers in terms of meeting the methodological requirements. The contents of the researches showed greater variability between the groups. While chemistry student teachers mostly studied students' understanding and misconceptions of certain concepts and ideas in chemistry, the majority of the projects done by the biology student teachers were based on literature search-type studies such as documenting and critiquing the research done on a certain concept of biology and analysis of biology textbooks in terms of presenting the biology contents. As the contents of the studies varied, the responses given to the questionnaire on the basis of experience gained showed greater variability and also the structure and the contents of the research reports. This perhaps could explain the greater variability between the two groups. In the following section, the results of analysis of the student teachers' research reports are presented in Table 2 and discussed.

Table 2. Analysis of student teachers' research reports

Are there evidences for:	Chemistry (n=6)		Biology (n=8)		Total (n=14)	
	Yes	No	Yes	No	Yes	No
A - Introduction						
What is studied?	4	2	7	1	11	3
Why is that particular topic investigated?	*2*	*4*	*2*	*6*	*4*	*10**
Is related literature reviewed?	5	1	6	2	11	3
What is/are the main aim/s of the study?	4	2	7	1	11	3
What is/are the research question/s?	*2*	*4*	*3*	*5*	*4*	*10**
B - Research Methodology						
What is the research method employed?	*2*	*4*	*2*	*6*	*4*	*10**
Are the strengths and weaknesses of the employed methods explained?	*1*	*5*	*1*	*7*	*2*	*12**
Is/Are the data collection tool/s explained?	6	0	6	2	12	2
Are the sampling procedures explained?	6	0	5	3	11	3
How is the data gathered analysed?	3	3	4	4	7	7
What issues are involved regarding reliability and validity?	1	5	1	7	2	12
C - Findings and Conclusions						
What are the main findings of the study?	5	1	7	1	12	2
What issues are involved in generalising the findings?	*0*	*6*	*0*	*8*	*0*	*14**
What is learned about the process of doing research?	*1*	*5*	*1*	*7*	*2*	*12**
What implications could be provided for further research and practitioners?	5	1	4	4	9	5
D – References						
Are there enough references? (at least 10 should be cited)	6	0	6	2	12	2
Are there different types of references (books, journal papers, conference proceedings)	4	2	1	7	5	9
Are the references cited correctly?	5	1	3	5	8	6
Are the references cited up to date?	6	0	5	3	11	3

**** indicates significant methodological deficiencies.***

As seen from Table 2, research reports more or less met most of the criteria. However, there are places where student teachers failed to meet the criteria. These criteria are indicated as *italic* in Table 2 and given below:

- *Why is that particular topic investigated?*
- *What is/are the research question/s?*
- *What is the research method employed?*
- *Are the strengths and weaknesses of the employed methods explained?*
- *What issues are involved in generalising the findings?*
- *What is learned about the process of doing research?*

All of the above criteria were ignored, or not mentioned, in at least 10 out of 14 research reports. For example none of the student teachers discussed what issues are involved in generalising the research findings. The criteria given above are important in terms of increasing the quality of research. Including the above points into research reports help student teachers to criticise their work and reflect what they had learned by doing such research projects. Therefore, it could be advised to supervisors to note these points in the research reports. Otherwise, as it is the case, most of the research reports would not go beyond describing the results without a critical discussion of what had been done and found.

Conclusions and discussion

This qualitative study examined student teachers' views on the value of undertaking small-scale research as part of the secondary teacher training course, and evaluated quality of the research reports prepared by the student teachers in terms of meeting the methodological requirements. This study contributes to the literature that Cordingley (1999) described as reflective (research- and evidence-based) practice of student teachers. The results of the study indicate student teachers valued small-scale research project as a learning activity, and gained significant knowledge of research methodology as well as title/concepts they studied and problem-solving skills. There is [a]considerable indication that student teachers understood the importance of misconceptions in students' acquisition of concepts. Doing research helped student teachers to see what problems are encountered in concept learning. Student teachers developed knowledge of educational issues and reasoning skills. In conjunction with this, student teachers expressed their appreciation that research can improve their classroom practice which could be considered as a sign of evidence-based education. This is very encouraging. Evidence-based education is that practices can be improved, leading to better outcomes for learners, if evidence from research is collected and applied systematically to inform the decisions that practitioners (of all sorts) have to take in the course of their work (Millar *et al.*, 2002, p. 19). What is also encouraging is that many student teachers considered that they had gained knowledge about the quality of students' learning of concepts and once they become teachers, they will be more cautious about teaching basic concepts with

different teaching approaches developed as a result of recent developments in theories of learning for better teaching. The result that some quarter of the student teachers are motivated to do research or participate in research projects was also another encouraging result, although they recognised possible limitations as researchers.

In very broad terms, the small-scale research project has proved a useful educational activity for secondary teacher training course. Here it is of note that a significant number of student teachers expressed their reservations on the problems encountered through the process. The common complaints expressed are time restrictions, choosing titles to research and inconsistent approaches to the course between the supervisors. These problems, in fact, could easily be solved through close cooperation of supervisors taking part in the projects. By taking into account the students' concerns caused by a possible failure in the KPSS examination, the title of the research topics could be consistent with the topics covered in the KPSS examination. Furthermore, it seems to be important to discuss extensively the various *hows* and *whys* in conducting research (Brinkman & Van Rens, 1999).

There is a clear indication that many of the student teachers have gained an appreciation of the value of the findings of educational research to classroom practice. They have also come to appreciate the potential contribution that they, as student teachers, will share their experiences gained with more experienced teachers. These results are consistent with the suggestions made by Bennett and Campbell (2002). Although there was some opposition, there was an overwhelming support for teachers to do research. It was asserted that doing research and reading research should not be considered as producing the similar effect in the quality of teaching. The willingness of student teachers to engage both *with* and *in* research may have a direct impact (rather than merely an awareness-raising function) upon specific classroom practices (Everton *et al.*, 2000). This suggests that the idea of an 'evidence-based profession' is not an impossible one. It is also important to note that student teachers are aware of working condition of teachers prior to teaching and this creates some kind of disturbances in their views towards being action researchers once they are established in teaching.

With respect to the quality of research reports written by student teachers, some important methodological deficiencies were found. Deficiencies mainly gathered around acquiring critiquing skills and synthesis of findings of the research done. Student teachers would benefit at this early stage from their research projects by critiquing what they did to make use of knowledge or skills derived from research or, indeed, from any other source, thus a process of internalisation is necessary. Doing research requires describing the findings as well as providing a critical discussion of what had been found. The majority of research reports investigated in this study lacked this aspect. Supervisors should take special care and provide more help to student teachers in this matter. A good teacher will be keen to coach student teachers during this process (Van Der Schee & Rijborz, 2003).

Implications for teaching

Although this study was small in scale, the evidence gathered suggests that inclusion in secondary teacher training courses of opportunities for student teachers to gain research experience is of considerable benefit. As suggested by Bennett and Campbell (2002), if we expect teachers to take note of research findings and, in particular, for some of them to be action researchers, we need to create opportunities for student teachers to gain experience of actually doing educational research, not just reading about it (p. 59). Teacher education programmes should promote the value of educational research. However, if it was expected that this small-scale research project reaches its ultimate aim, the following revisions might be considered as a starting point for a possible improvement: the inconsistent approaches between the supervisors should be overcome. To do this, at the beginning of each semester, supervisors may come together and have a discussion of what kind of projects will be assigned and help provided to supervisees. At this point, by taking Hagger and McIntyre (2000)'s suggestion that useful research for teacher education would take teaching and learning in schools into account, topics to research could be chosen from secondary chemistry or biology coverage. Moreover, a medium in which knowledge and experiences gained by student teachers could be exchanged should be provided so that dissemination of knowledge is achieved. This medium could be a one-day poster conference (Bennett & Campbell, 2002) or a few hours of in-class discussions towards the end of the course. Furthermore, in order to overcome student teachers' concerns for the KPSS examination, the title of the research projects may also be chosen so that titles covered by the KPSS examination such as planning and assessment are included, properties of teaching methods, knowledge acquisition, etc. This may lessen exam pressure felt by student teachers.

Finally, it is obvious that if we are to have future teachers who are active researchers, we must also have teacher educators who are prepared to be the same (Cochran-Smith, 2003). Student teachers who complained about the problems encountered in the process of their projects may have been caused by the teacher educators who did not become action researchers. In this sense, education of teacher educators from an evidence-based practice stance can be understood as playing a significant part in the future of society.

Notes

1. **R** and **I** stand for Researcher and Interviewee respectively in the dialogues taken from interviews.

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Appendix 1. The questions used in the questionnaire.

1. What were the most and least valuable aspects of the study?
2. How might you use the knowledge and skills gained?
3. What are your views on the appropriateness of this type of assignment at this stage of a Master without Thesis programme?

4. How has carrying out the assignment influenced your views of use of educational research in teaching practice?
5. What are your views on the value of teachers carrying out educational research?
6. Having done your research projects, and had an opportunity to find out what others have done, what (if any) research might you like to do when you become a teacher?

Appendix 2. Criteria used for evaluation of the research reports.

Evidences are sought whether the following points were addressed in the research reports.

Introduction

What is studied?
Why is that particular topic investigated (the importance of the topic)?
Is related literature reviewed?
What is/are the main aim/s of the study?
What is/are the research question/s?

Research methodology

What is the research method employed?
Are strengths and weaknesses of the employed methods explained?
Is/Are data collection tool/s explained?
Are sampling procedures explained?
How is gathered data analysed?
What issues are involved regarding reliability and validity?

Findings and conclusions

What are the main findings of the study?
What issues are involved in generalising the findings?
What is learned about the process of doing research?
What implications could be provided for further research and practitioners?

References

Are there enough references? (at least 10 should be cited)
Are there different types of references (books, journal papers, conference proceedings?)
Are the references cited correctly?
Are the references cited up to date?