A study of Science Teachers' Perceptions of their Educational Preparation

Hassan H. Tairab
College of Education,
United Arab Emirates University

Abstract:

The study examines science teachers' views about their academic and professional preparation and its balance in producing well-qualified and well-trained science teachers. The study was carried out against the background of recent calls for teacher education to be structurally changed and redesigned to comply with recent national and international educational developments.

The results described in this paper were based on data collected using a questionnaire administered to 34 primary and 30 secondary prospective science teachers. The questionnaire sought to determine their perceptions of their level of academic and professional preparation and its balance in producing well-qualified and well-trained science teachers. The questionnaire was based on a teacher education conceptual framework recently adopted by the College of Education of the United Arab Emirates University, and Danielson's (2002) model for teaching.

Analyses of the data collected indicated that the overall view of the recent graduate science teachers of their preparedness is largely one of satisfaction, at least from their own perspectives. However, although the science teachers responded that they were adequately prepared in most categories, some educators would argue that graduates should be well prepared in all the surveyed categories. Implications for teacher education were presented and discussed.

Introduction

Many educational researchers see teachers as the main agent of change in educational reform and in raising students educational the standards (Black, & William, 1998; Trowbridge, Bybee, & Powell, 2004). As such, studies on teaching and teacher education are conducted from various perspectives (Creamers, 1994; Hargreaves, 1996; Korthagen and Kessels, 1999; Loughran, 2002, Shulman, 1987; Tairab, 2003). The ultimate goal of these and other studies is to improve teacher quality and hence the

education of children. However, it has been a norm for a long time that teachers and teaching have been studied from an external viewpoint with little attention given to teachers' knowledge and beliefs, or to the contexts in which they work.

In recent years, more attention has been paid to constructs such as teacher knowledge, perception, and beliefs through the use of models in which these constructs were examined from an internal insider's perspective (Batteson, 2000; Betoreta and Artiga, 2004; Kember, 1997; Kember & Kwan, 2001; Morely, 1999, Marla, 2006). From this perspective, the teacher is assumed to be a dynamic agent who takes decisions, weighs up situations and expresses his/her thoughts and theories through his/ her acts.

Moreover, and in recent years, much has been written about teacher education and the preparation of elementary and secondary science teachers in particular (Bryan & Atwater, 2002; Kim, 2006; Meadows & Koballa, 1993; McGinnis et al., 2002; Thomas & Pedersen, 2003). Many national and international reports have led to reforms in science teacher education and have focused attention on the effectiveness of science teacher preparation programs (Simmons et al., 1999); some of these have focused on teachers' attitudes and beliefs regarding the teaching of science (Bryan, 2003; Bryan & Atwater, 2002; Southerland, Gess-Newsome, & Johnston, 2003; Thomas & Pedersen, 2003).

Other reports and continuing research studies indicate that teacher preparation programs have had little impact on the beliefs and practices of our pre-service students (Raizen & Michelsohn, 1994; Thomas & Pedersen, 2003). While the debate about the effectiveness of teacher education program goes on, this study was carried out at a time of intensive redesigning and reviewing process undertaken by the College of Education, United Arab Emirates University, in order to improve its teacher training programs and bring them to internationally recognized standards.

Purpose

The primary aim of this study was to contribute to the discussion about how to better prepare teachers in the COE taking the perspective of the graduates themselves into consideration rather than any external perspectives. These perspectives are gained in the light of their practical knowledge and experience gained from the redesigned and reviewed teacher

education programs offered at the College of Education, of the UAE University. The purpose of this study was therefore to explore prospective elementary and secondary school science teachers' perceptions about their own preparation program. Specifically, the study intends to find answers to questions about:

1. The extent to which the participants (prospective science teachers) feel they are prepared to teach science.
2. The extent to which the participants feel they were prepared or not to effectively teach science in schools.
3. Participants' perceptions about the balance between various components that make up their teacher education program.
4. The similarities and differences between the views expressed by both prospective elementary and secondary school science teachers regarding their respective teacher education programs.

It is hoped that the findings of this study will provide guidance relevant to key future educational reforms regarding the development of programs that will foster prospective teachers' understanding of teaching and learning. It is suggested that in order to improve the way we educate our teachers, we must take into account the ways in which those teachers construe the way we have been preparing them. For future reforms, teacher education program review must take account of the ways in which students conceptualize and evaluate these programs.

It is from here that this study seeks to explore what the current teacher education program looks like from the perspectives of the students themselves rather than the views of the decision makers and teacher educators.

Theoretical Framework

This research study is grounded in the theoretical perspectives of teacher knowledge on the one hand, and on teacher reflection and perception as means to explore teacher knowledge in order to enhance reform in teacher preparation on the other hand. The paradigm shift from teaching to learning demands that we reassess what knowledge is required in order to be an effective teacher (Anderson and Mitchener, 1994; Kolis and Dunlap, 2004). The paradigm shift also makes it clear that teacher knowledge and teacher reflection and perception illustrate the dynamic

interplay between actual teaching and learning processes and future reform processes.

Teachers commonly are influenced by their prior knowledge and beliefs. They bring to classrooms a set of prior conceptions about teaching and learning that are shaped through their personal experience. As learner practitioners within community of learners, and cultures (Love & Kruger, 2005), their beliefs and prior perceptions interact and may influence their instruction, and hence student achievement. In addition to the beliefs teachers hold about teaching and learning, are their perceptions of the students they teach and the context in which they teach should be considered. These perceptions affect their interpretations of their own experiences and powerfully influence their knowledge and practices they will apply as teachers. Both teacher beliefs about learning and perceptions about their students translate into classroom instructional practice (Deemer, 2004; Stuart & Thurlow, 2000). These practices in turn, shape the dynamics of student learning.

Loughran, (2002) proposed teacher reflection as a reform process of "thinking and acting on those aspects of teaching that frustrate, confuse, and perplex" (p. 3). Engaging preservice teachers in reflection on their own views of learning and teaching allows greater insight into the kinds of experiences on which teacher education programs should be built to promote inquiry-based teaching (Simmons et al., 1999).

Given the assumption that teacher knowledge and perceptions influence instructional practice, an in-depth examination of teachers' perceptions of their educational preparation program described in this study was intended to provide a framework for understanding how teachers see their professional preparations and how this might influence their future practice. It also gives opportunity to reflect on the current reforms recently implemented by the College of Education.

The present research assumes that prospective science teachers develop and use interconnected expectations before entering a school room, suggesting that teachers use mental models and organized clustered sets or frames of expectations (Loughran, 2002). Furthermore, the present research assumes that teachers' professional frames are both individually and socially derived and shaped by experiences as well as by expectations and values. From early experiences as students, teachers develop vivid images of

teaching, according to Calderhead and Robson (1991). These images of good teaching and perceptions of personal skills affect students' interpretations of teacher education experiences and powerfully influence the translated knowledge and projected practices they will apply as teachers. Moreover, many factors shape the learning of preservice elementary and secondary science teachers; certainly previous life experiences impact the way in which each prospective teacher experiences his/her teacher education program. In the interest of current educational reforms and teacher education redesigning process, it is important to explore prospective teachers' views about the outcomes of these educational reforms.

Methodology

The context of teacher preparation program

The context of the present study is the College of the education of the United Arab Emirates University and its teacher preparation program. The Teacher preparation programs of the college were based on specifically designed conceptual framework. The COE conceptual framework constitutes all the principles, values, and concepts that make up all different levels of teacher preparation program. It is considered to be an umbrella covering all stages of teacher preparation program starting with the candidate's joining the college and ending with the candidate as a professional practitioner. Abiding by its vision and striving to achieve its mission, the College of Education works on preparing qualified teachers adopting the theme "Teacher as Professional Practitioner". The theme basically suggests that a reflective professional reflects as well as withholds judgments concerning a particular event and considers available alternatives to established practices. For example, a professional practitioner uses reflective practice to question aspects of teaching that are generally taken for granted, including their own beliefs and assumptions about the educational process. In this way, a professional practitioner makes decisions largely based on evidence and continually assesses the effects of decisions on others.

To achieve this, the College conceptual framework was developed using the standards of teacher professional organizations and focuses on a set of 12 elements to guides its programs and eventually the development of learning materials for these programs. Among the elements that are stressed

and included in the college conceptual framework is the ability of a teacher to be a reflective practitioner, inquiry oriented, a critical thinker, knowledgeable in the specialization, understand diversity and ethical teaching and professional issues. Thus, the conceptual framework has provided the theoretical support needed to develop the questionnaire used to explore the perceptions in this study.

On the other hand, Danielson's (2002) model for teaching describes those aspects of teachers' responsibilities that have been documented through empirical studies and theoretical research to enhance students' learning. The responsibilities seek to define what teachers should know and be able to do in the teaching profession. In this model, Danielson (2002) presents teaching as an activity pertaining to 4 areas, namely the ability to plan and prepare for teaching; the ability to design effective learning environment; the ability to execute planned and prepared teaching activities; and finally, the ability to model professional practices.

Design

The study employs a survey type design using a specially developed questionnaire to explore the participants' views about their programs. Surveys are an important technique used in educational research. They provide feedback from the point of view of the participants. A survey design is regarded by researchers as the most appropriate design when it comes to gathering opinions. Furthermore, it allows researchers to include as many participants as they wish easily and efficiently.

Instrument

The data for the present study were gathered by a questionnaire. The questionnaire was developed from a conceptual framework recently adopted by the College of Education of the United Arab Emirates University using the principles of Danielson's (2002) model for teaching and other professional organization standards on one hand, and the literature on teacher knowledge and beliefs on the other hand. In particular, professional organizations such as Interstate New Teacher Assessment and Support Consortium (INTASC), the National Board for Professional Teaching Standards (NBPTS), and the National Science Teachers Association (NSTA) standards and the literature on teacher knowledge and beliefs were used to draw frames of reference regarding what kinds of knowledge

teachers of United Arab Emirates should have in order to effectively teach science at both elementary and secondary schools.

The questionnaire used in this study elicited information on three areas: (1) demographic information, (2) components that describe teaching competencies, and (3) participants' views on the balance between various components that make up their teacher education program.

The 30-item questionnaire sought to determine the perceived value of these components in preparing student to teach as indicated in Danielson's (2002) model and the college conceptual framework. Each of these areas can be described in terms of components and indicators depicting the presence of these areas. Items for the questionnaire were developed using indicators for each of these areas as follows:

Table 1
Description of the questionnaire component

Area	items	Sample item
Planning and Preparation	Items 1 - 7	To demonstrate knowledge of how to select learning outcomes
Classroom environment	Items 8 - 13	To demonstrate knowledge of how to organize the physical classroom space
Instruction	Item 14 - 24	To demonstrate knowledge how to use appropriate questioning techniques
Professional responsibility	Item 25 - 30	To understanding of professional responsibilities

The rating scale used to reflect the participants' views was a 5-point Likert-type scale, which ranged from 5, indicating the participants' thought they had been "*highly prepared*" in particular components of the area, to 1, indicating that they thought they had "*not been prepared at all*" in that item. The balance of time for elements of the teacher education program was given a rating scale of 4 to indicate that "*too much time given*" and 1 to indicate that "*too little time given"***.**

The participants' views on the balance between various components that make up their teacher education program were gathered by the last

section of the questionnaire which was made up of statements describing the balance of time devoted in the preparation program.

A panel of three university professors in science education and two science teachers reviewed the items of the questionnaire for their relevance and suitability for the purpose of the study. The questionnaire was field tested with a group of 30 elementary and secondary education undergraduates and then modified for clarity, organization, and content based on feedback from those individuals. The calculated reliability of the 30-item section of the questionnaire for the main study was found to be 0.81 which was deemed to be suitable for the purpose of the study.

Sample

A total of 64 primary and secondary prospective science teachers were included in this study. All participants were females and were in their final semester of the study at the time when they responded to the questionnaire. They were already undertaking teaching practice in schools as the final components of their teacher education program. All elementary prospective science teachers (N = 34) followed a double major program (science and mathematics), whereas secondary prospective science teachers (N = 30) followed a single subject major (e.g. biology, chemistry or physics). Of the 30 secondary prospective science teachers, 12 were majoring biology, 8 were majoring chemistry, and the remaining 10 were majoring physics. The sample of the study represents 96% of all pre-service science teachers enrolled during the academic years 2005 and 2006.

Procedures

Participants were given the questionnaire during their posting to schools for their teaching practice. Participants were instructed to respond to the questionnaire taking into account the result of their training as prospective science teachers, and to indicate the extent to which they perceived themselves as prepared to teach science effectively at their respective schools level using a 5-point Likert-type rating scale. Furthermore, participants were also asked to indicate the extent to which time was given in their training to certain elements often included in teacher education programs using a 4-point rating scale. Participants were given

ample time to read and respond to the questionnaire items, and they were encouraged to complete all items and all components of the questionnaire.

Results

The present study focused mainly on prospective science teachers' perceptions of their preparation in terms of how well they felt they were prepared to effectively teach their major subjects in schools. In order to explore the participants' responses, the data analysis was based on the areas described in Danielson's (2002) model of teaching. These areas will be used below to describe the responses of participants. Percentages scores for each item were presented in the following tables to the extent of preparedness of prospective science teachers as regard to teaching their majors in schools.

Prospective Teachers' Perceptions of Preparation in Planning and Preparation

As can be seen from Table 2, only in items 2 and 3 did more than half of the participants felt that they had been "highly" or "well prepared" to teach science when it comes to knowledge of students and their characteristics. However, most felt that they had been "adequately prepared". These results compare somewhat unfavorably with previous findings (Betoreta and Artiga, 2004) where the majority was satisfied with the level of preparation in these aspects.

Table 2
Perceptions of Preparation in Planning and Preparation

	Item	Rating				
		Highly prepared	Well prepared	Adequately prepared	Not well prepared	Not prepared at all
1	To demonstrate knowledge of content and pedagogy in the specialist subject	9 (14.1%)	8 (12.5%)	38 (59.3%)	9 (14.1%)	0.0 (00.0%)
2	To demonstrate knowledge of student characteristics	6 (9.3%)	34 (53.1%)	24 (37.5%)	0.0 (00.0%)	0.0 (00.0%)
3	To demonstrate knowledge of interest, learning styles and culture	4 (6.2%)	32 (50%)	28 (43.7%)	0.0 (00.0%)	0.0 (00.0%)
4	To demonstrate knowledge of how to select learning outcomes for students	5 (7.8%)	20 (31.3%)	29 (45.3%)	5 (7.8%)	5 (7.8%)
5	To demonstrate knowledge of how to select and use appropriate resources	0 (00.0%)	14 (21.9%)	23 (35.9%)	12 (18.7%)	15 (23.4%)
6	To demonstrate knowledge of designing coherent instruction in terms of selection of appropriate activities, instructional materials, and group formation	3 (4.6%)	10 (15.6%)	38 (59.4%)	9 (14.1%)	4 (6.3%)
7	To demonstrate knowledge of assessment and evaluation techniques appropriate for students.	5 (7.8%)	5 (7.8%)	29 (45.3%)	15 (23.4%)	10 (15.6%)

The position is even more unfavorable with item 1, 4, and 6. With regard to "Ability to demonstrate content knowledge of what they teach" only about 14.1% felt that they were not well prepared in this important component. Similarly 15.6% and 20.4% were either not well prepared or not prepared at all in selection of learning outcomes and appropriate learning activities. This result closely matches results of content knowledge examinations offered at the end of their program where most students find it

difficult to obtain high scores in the content knowledge examinations. It may be noted that part of the dissatisfaction of prospective science teachers with their level of subject matter knowledge may be due to the lack of integration between what they teach at school and what they studied at the university. The teacher education program is taught jointly with the College of Science where the science content is taught by the College of Science's relevant department, whereas pedagogical knowledge and supervision is carried out in the College of Education. This result suggests that closer harmonization of subject knowledge with its application must be seriously considered and actively implemented. Table 2 also shows that ability to demonstrate knowledge of selection of teaching resources (item 5) and assessment techniques (item 7) was also lacking among the participants where about 42% and 39% respectively felt that they were either not well prepared or not prepared at all in these categories to teach in schools.

Prospective Teachers' Perceptions of Preparation in Classroom Environment

Table 3 shows that although generally more than half of the participants believed that they had been adequately prepared or better, some doubts emerge from these results. As seen from items 9 in the table, about 37% of participants felt that they were either not well prepared or not prepared at all. Again, 25%, 31.2%, and 42.2% of the respondents felt that they were not well prepared or not prepared at all in skills such as: handling classroom discipline problems, demonstrating the knowledge of classroom management procedures when managing instruction, and using strategies to foster interest and motivation.

Table 3 also shows a mismatch between the components of classroom management. While participants generally felt confident in their ability to create a positive classroom environment and establish a culture for learning, they rated their ability to motivate and handle classroom problems lower. Further research is needed to find out about this mismatch between the participants' belief that they were prepared to create a positive classroom environment and culture for learning and their lower estimation for their ability in areas such as the ability to motivate students and handle their classroom problems.

Table 3
Perceptions of Preparation in Classroom Environment

	Item	Rating				
		Highly prepared	Well prepared	Adequately prepared	Not well prepared	Not prepared at all
8	To demonstrate knowledge of how to create classroom environment of respect and rapport	6 (9.4%)	24 (37.5%)	28 (43.7%)	6 (9.4%)	0 (00.0%)
9	To demonstrate knowledge of how to establish a culture of effective learning	6 (9.4%)	6 (9.4%)	28 (43.7%)	18 (28.1%)	6 (9.4%)
10	To demonstrate knowledge of classroom management procedures when managing instruction, materials, and students	5 (7.8%)	18 (28.1%)	25 (39.1%)	7 (10.9 %)	9 (14.1%)
11	To demonstrate knowledge of how to organize the physical classroom space	3 (4.7%)	15 (23.4%)	34 (53.1%)	12 (18.8%)	0 (00.0%)
12	To maintain interest and motivation of students	3 (4.7%)	18 (28.1%)	23 (35.9%)	20 (31.2%)	0 (00.0%)
13	To handle classroom discipline problems	3 (4.7%)	14 (21.9%)	20 (31.3%)	23 (35.9%)	4 (6.3%)

Prospective Teachers' Perceptions of Preparation in Instruction

The main areas of teaching skills under the category of instruction in Danielson's (2002) model of teaching were using appropriate communication skills at the level of explaining as well as questioning in addition to the use of various strategies that engage students and provide feedback on the achievement of learning outcomes. The competencies that made up the teaching categories included the abilities to use technology in teaching, to adjust teaching through an awareness of students' psychological needs, and to understand role of schools.

Generally, the majority of participants expressed satisfaction with their preparation for basic teaching skills and methodologies they were to use during teaching (items 14, 15, 16, 17 and 19). It is perhaps unsurprising that

the participants were positive about the role of reflection (item 19) and their ability to adopt a critical stance on educational issues, judging by the fact that reflection practices are now a fundamental component of their teacher education training.

Table 4 ***Perceptions of Preparation in Instruction***

	Item	Rating				
		Highly prepared	Well prepared	Adequately prepared	Not well prepared	Not prepared at all
14	To demonstrate knowledge of using appropriate language for communication with students both in written and oral format	3 (4.7%)	10 (15.6%)	38 (59.4%)	9 (14.1%)	4 (6.3%)
15	To demonstrate knowledge how to use appropriate questioning techniques	5 (7.8%)	12 (18.6%)	34 (53.1%)	9 (14.1%)	4 (6.3%)
16	To demonstrate knowledge of how to engage students in learning	5 (7.8%)	10 (15.6%)	29 (45.3%)	16 (25.0%)	4 (6.3%)
17	To demonstrate knowledge of how to provide feedback to students	4 (6.3%)	24 (37.5%)	11 (17.2%)	20 (31.2%)	5 (7.8%)
18	To demonstrate knowledge of how to adjust instruction to suit student needs when appropriate	3 (4.7%)	19 (29.7%)	21 (32.8%)	19 (29.7%)	2 (3.1%)
19	To be able to reflect on and be critical of development as a science teacher	9 (14.1%)	27 (42.1%)	25 (39.1%)	3 (4.7%)	0 (00.0%)
20	To demonstrate knowledge of how to assess and record student progress	9 (14.1%)	23 (35.9%)	20 (31.3%)	6 (9.4%)	6 (9.4%)
21	To use teaching strategies appropriate to age, ability and level of students	7 (10.9%)	18 (28.1%)	21 (32.8%)	18 (28.1%)	0 (00.0%)
22	To be aware of social, psychological, and cultural differences among students	6 (9.4%)	19 (29.7%)	18 (28.1%)	21 (32.8%)	0 (00.0%)
23	To present concepts in clear and appropriate language to students	5 (7.8%)	25 (39.1%)	32 (50.0%)	2 (3.1%)	0 (00.0%)
24	To use and implement technology in teaching and learning	5 (7.8%)	10 (15.6%)	21 (32.8%)	14 (21.9%)	14 (21.9%)

However, the major conclusion that can be drawn from Table 4 is that so few participants believed that they were highly prepared in these teaching competencies, and about 33% and 44% of participants felt that they were either *not well prepared* or *not prepared at all* in how to handle cultural differences and how to implement technology in teaching and learning. Participants' confidence in their ability to carry out teaching and learning activities varied. Most participants were confident with their ability to ask questions and explain concepts using clear and appropriate language, yet there was a high percentage of them who felt that they were not adequately prepared in how to adjust instruction (item 18) and appreciate diversity in classrooms (item 22), although there has been a general acceptance for the need for teachers to be able to teach across a wide ability range.

It is also worrying that about 44 % of participants felt that they were either not well prepared or not prepared at all to use and integrate technology in teaching. This would seem to be an area that needs a concentration of efforts if we have to improve prospective teachers' confidence in the use of technology in teaching. Given the technological resources currently available in training these prospective teachers, it seems paradoxical that such a high percentage of participants (44%) felt that they were not prepared on the use of and integration of technology in teaching.

Prospective Teachers' Perceptions of Preparation in Professional Responsibility

This category is concerned with the preparation of prospective teachers for the wider professional role and responsibilities in the school that the "teacher as a professional practitioner" is expected to play. Throughout the educational world, there is a renewed emphasis on the role of the teacher as a professional practitioner who is able to bring the school to its community and transform and transfer learning to community context. It is also realized that schools should take a more active role and teachers should be aware of the factors that lead to effective schools (Stoll and Fink, 1996). Under such circumstances, teachers are expected to play various roles such as communicating with parents, colleagues, and the community at large.

Generally speaking, as Table 5 shows, the results presented in this category were encouraging. Over three quarters of participants felt that they had been highly prepared, well prepared or adequately prepared in all competencies perceived in this section. Participants generally felt they will be able to cope well with the social and communal aspects of their role. They felt that they would have no problem in communicating with parents and officials about curriculum matters and students. They appeared fully aware of their professional responsibilities and their duties in contributing to schools and educational zones.

Table5 Perceptions of preparation in Professional Responsibilities

	Item	**Rating**				
		Highly prepared	Well prepared	Adequately prepared	Not well prepared	Not prepared at all
25	To communicate with parents, and officials about curriculum and other educational matters that concern student learning	5 (7.8%)	24 (37.5%)	24 (37.5%)	6 (9.4%)	5 (7.8%)
26	To understand professional responsibilities	19 (29.6%)	20 (31.3%)	25 (39.1%)	0 (00.0%)	0 (00.0%)
27	To demonstrate knowledge of how to contribute professionally to schools and educational zones	16 (25.0%)	38 (59. 4%)	10 (15.6%)	0 (00.0%)	0 (00.0%)
28	To develop effective working relations with colleagues	11 (17.2%)	25 (39.0%)	12 (18.8%)	11 (17.2%)	5 (7.8%)
29	To demonstrate knowledge of how to be proactive in serving students, parents, and other community members	10 (15.6%)	21 (32.8%)	19 (29.7%)	14 (21.9%)	0 (00.0%)
30	To demonstrate knowledge of how to make professional decisions on matters related to work	12 (18.6%)	27 (42.2%)	11 (17.2%)	6 (9.4%	8 (12.5%)

While it is believed that students who enrolled elementary education program differ from that of the secondary program and tend to have different attitudes toward subject matter and science teaching, data shown in Table 6 does not support this view. When participants' responses were analyzed taking into account the level of preparation, e.g. elementary versus secondary, there were no statistically significant differences between the two groups of prospective science teachers. Both groups responded in an almost similar way with the elementary education group tending to have higher mean scores in all teaching components assessed by the questionnaire.

Table 6: Descriptive Statistics Perceptions of teaching components by prospective teachers' groups

	Elementary		Secondary		
Component	M	SD	M	SD	t-value
Planning and preparation	3.17	0.38	3.09	0.15	1.138
Classroom environment	3.16	0.58	2.98	0.70	1.091
Instruction	3.19	0.35	3.15	0.41	0.371
Professional responsibilities	3.58	0.27	3.57	0.31	0.057

Balance of Time of Allocated to Program Components

Participants were asked to indicate the extent to which time was given to the certain elements that are regarded as important components of their teacher education program (see questionnaire).

Conventionally, researchers have always found criticism among teachers over the perceived imbalance between the "theory" and the "practice" of teacher education programs (Sweeny, 2003). Universally, most students including prospective teachers seem to want more 'practice' and less 'theory'. However, the relationship between theory and practice is

essentially interactive. Thus, prospective teachers should be encouraged to generate their own theories and link them to practice.

With regard to the balance of time given, prospective science teachers were divided between too much time (40.6%) and sufficient time (50%) as to the time allocated to studying subject matter knowledge. Two other elements of the program were considered to have either too much time or sufficient time given to them. They included, firstly, time given to studying educational theories and principles (31.3% too much, and 43.8% sufficient time) and, secondly, time spent on teaching practice (29.7% too much, and 40.6% sufficient time). However, it is worth noting that the majority (90%, 81.2%, and 59.4%) felt that very little or too little time was devoted to school visits, field and practical work, and microteaching activities.

Table 7 Perception of the balance of time given to teacher education program components

	Element	**Too much time**	**Sufficient time**	**Very Little time**	**Too little time**
1	Time to study subject matter knowledge	26 (40.6%)	32 (50.0%)	6 (9.4%)	0 (00.0%)
2	Time to study educational theories and principles	20 (31.3%)	28 (43.8%)	6 (9.4%)	10 (15.6%)
3	Time to study methodologies of teaching	9 (14.1%)	45 (70.3%)	6 (9.4%)	4 (6.2%)
4	Time to study classroom environment and management	14 (21.9%)	45 (70.3%)	5 (7.8%)	0 (00.0%)
5	Time to study student assessment and evaluation	12 (18.8%)	45 (70.3%)	7 (10.9%)	0 (00.0%)
6	Time spent in school visits	0 (00.0%)	6 (9.4%)	32 (50.0%)	26 (40.6%)
7	Time spent in microteaching	0 (00.0%)	26 (40.6%)	38 (59.4%)	0 (00.0%)
8	Time for teaching practice in schools	19 (29.7%)	26 (40.6%)	19 (29.7%)	0 (00.0%)
9	Time for field and practical work	0 (00.0%)	12 (18.8%)	45 (70.3%)	7 (10.9%)

Given the time allocated to the subject matter knowledge (40.6% too much and 50% sufficient), it seems that the theoretical aspects have been more emphasized than fieldwork and practical activities. This account seems to be at odds with the apparent program goals and objectives which focus on practical and hands-on activities and real life experiences. Clearly the findings of this section point to the need to adopt a more practical approach to teacher education program whereby practical activities are emphasized and given ample time so that students can develop their own teaching and learning perspectives, which may lead to generation and application of more pedagogically-based theories.

The balance of time given in the two programs was analyzed individually for the two groups to compare their mean scores. The results are shown in Table 8.

Table 8: Descriptive Statistics Perceptions of the balance of time given to teacher education program components

	Elementary		Secondary		
Element	M	SD	M	SD	t-value
Time to study subject matter knowledge	3.14	0.70	3.51	0.50	2.49**
Time to study educational theories and principles	2.94	1.00	2.80	1.10	0.535
Time to study methodologies of teaching	3.06	0.79	2.83	0.52	1.389
Time to study classroom environment and management	3.02	0.52	2.86	0.57	1.191
Time to study student assessment and evaluation	3.11	0.59	3.03	0.49	0.624
Time spent in school visits	1.58	0.60	1.60	0.56	0.537
Time spent in microteaching	2.38	0.49	2.33	0.47	0.402*
Time for teaching practice in schools	3.09	0.75	2.66	0.88	2.060*
Time for field and practical work	2.00	0.49	2.16	0.59	1.023

** P < .05, ** P < .001*

Table 8 showed that there were statistically significant differences between the mean scores of prospective elementary education science teachers and those of their counterparts in the secondary education program in three of the nine assessed elements of the two programs. Consequently, the two groups were equivalent on the remaining 5 elements. It is interesting to note that secondary education program participants showed favorable views with regard to the time given to the subject matter knowledge, while the elementary education program participants favored the time given to the pedagogy aspects such micro-teaching and field experience.

Discussion and Conclusion

Although there is an abundant, diverse and expansive literature on teacher education that represents the process of becoming a teacher, much less has been available in the UAE context. One of the purposes of this study is to encourage prospective and in-service teachers to reflect critically on programs and practices so that future reforms can be carried out systematically and meaningfully. The survey described in this study focused on the perceptions of prospective science teachers of their preparedness to become effective teachers following their completion of their teacher education program. The assessment of their perceptions was made on the basis of a conceptual framework used as a grounding theory for their program as well as on Danielson's (2002) model of teaching. The overall view of the prospective science teacher is largely one of satisfaction. Although many points of concern were raised above, a glance at tables 2 – 5 will show that for most items the participants believed that they were, at least ‘adequately prepared’. However, it may be argued that a comparison of the stated program goals with these results suggests that more attention is needed to balance teacher education program goals. It may also be argued that, at a minimum, the majority of our prospective teachers should believe that they were at least 'highly prepared in every category assessed in this study”.

Although the intention of this study was to explore participants’ views about the effectiveness of the program rather than their personal attitudes toward teaching and learning, an attempt was made to look at the responses of the participants according to their preparation programs. The participants tended to exhibit similar perceptions to their preparation programs as no

statistically significant differences between prospective elementary and secondary science teachers.

With the regard to the balance of time given to nine elements assessed in this study, it appears that only 3 elements were viewed differently by the two groups. This could be due to the nature of the preparations of the two programs. There are some aspects of similarities between the two programs that make them resemble each other not in terms of outcomes but in the implementation process. For example both programs follow a similar cycle of field experience as well as on-the field assessment methods, and both groups taught the content component at the College of Science with more science content knowledge being emphasized in the secondary education program.

Finally, in this study, the issue of effective teachers and teaching is indirectly highlighted from the perspective of prospective science teachers' perceptions. Their conceptions of teacher education consist of their reflections on the goals of teacher education program as modeled by the conceptual framework adopted by their college which was largely based on teacher knowledge, and the corresponding model of teaching described by Danielson (2002). Altogether these views were seen from an angle of being able to plan and prepare, create a positive classroom environment, carry out planned activities, and being able to model professional activities that lead to professional practice.

One feature that is emphasized by the participants is the seeming inability of their program to take care of certain components that are essential for effective teaching. The ability to select appropriate learning resources and assessment strategies as well as understanding cultural issues and integration of technology in teaching and learning processes are all among the components that require revisiting,

Implications of the study

The findings of the present study suggest a number of implications. The study provided valuable feedback to curriculum developers and program planners. If we honestly want to continuously improve our teacher education programs, we must take into account such feedback. Assessment by prospective teachers of their educational programs has become a worldwide phenomenon as the result of the recent efforts to improve and

reform educational practices (Bryan & Atwater, 2002; Thomas & Pedersen, 2003). Teacher educators can and should learn a great deal from the experiences of prospective teachers. Thus, if we intend to reform teacher education programs, we must take into account the ways in which prospective teachers perceive their preparation. Just as good teachers learn from good practice of other teachers, so should teacher educators adapt an approach that recognizes the emerging professionalism of prospective teachers. Prospective teachers' experiences have such a wide- range and long-term impact upon not only themselves but also the context in which they are trained.

Another area that requires attention is the balance of time given to teacher education activities. While the debate between theory and practice is still unresolved, we certainly need to balance our teacher education programs in order to adequately address both theory and practice. Just as the balance of time is important, we need to balance the subject matter content and align it with the stated goals and objectives.

The findings of this study point to the need for systematically gathering perceptual information from students and continuously reexamining teacher education program structure so that desired outcomes are sustained. Although the findings suggest that participants are mostly satisfied with the kind of preparation activities offered through their programs, there is still rooms for improvement to at least a point that students feel they are highly and very well prepared in all the categories examined in this study.

References

Anderson, R. D. & Mitchener, C. P. (1994). Research on science teacher education. In D. L. Gabel (Ed.), Handbook of research on science teaching and learning: A project of the National Science Teachers Association (pp. 3-44). New York: Macmillan Publishing Company.

Batteson, C. (2000). Teacher education in England and Wales. *International Studies in Sociology of Education,* 10 (1), 103- 109.

Betoreta, F. and Artiga, A. (2004). Trainee teachers' conceptions of teaching and learning, classroom layout and exam design. *Educational Studies*, Vol. 30(4), 355 – 372.

Black, P. & William, D. (1998). *Inside the black box: Raising the standards through classroom assessment*, King's College, London.

Bryan, L. (2003). Nestedness of beliefs: Examining a prospective elementary teacher's belief system about science teaching and learning, *Journal of Research in Science Teaching*, Vol. 40, 835 - 868.

Bryan, L. & Atwater, M. (2002). Teacher beliefs and cultural models: A challenge for science teacher preparation programs, *Science Education*, 86, 821 - 839.

Calderhead, J. & Robson, M. (1991). Images of teaching: Student teachers' early conceptions of classroom practice. *Teaching and Teacher Education*, Vol. 7, 1-8.

Creamers, B.(1994). *The Effective Classroom*. London, Cassell.

Danielson, C. (2002). *Enhancing Professional Practice: A Framework for Teaching*, Association for Supervision & Curriculum Development.

Deemer, S. A. (2004). Classroom goal orientation in high school classrooms: Revealing links between teacher beliefs and classroom environment. *Educational Research*, Vol., 46(1), 73 - 90.

Hargreaves, D. (1996). *Teaching as A research-based Profession: Possibilities and Prospects*. London: Teacher Training Agency.

Kember, D. (1997) A re-conceptualization of the research into university academics' conceptions of teaching, *Learning and Instruction*, Vol. 7(3), 255 - 275.

Kember, D. and Kwan, K. P. (2001) Lecturers' approaches to teaching and their relationship to conceptions of good teaching, Instructional Science, Vol. 28(6), 469 - 490.

Kim, B. (2006). Changes in Preservice Teachers' Attitudes and Beliefs: The Net Impact of Two Mathematics Education Units and Intervening Experiences. *School Science and Mathematics*, Vol.106(1), 36 - 47.

Kolis, M. and Dunlap, W. (2004). The knowledge of teaching: the K3P3 model. *Reading Improvement*, Vol. 41(2), 97 – 107.

Korthagen, F. A. and Kessels, J. P. (1999). Linking theory and practice: Changing the pedagogy of teacher education. *Educational Researcher*, Vol. 28 (4), 4- 17.

Loughran, J.J. (2002). Effective reflective practice: In search of meaning in learning about teaching. *Journal of Teacher Education*, Vol. 53 (1), pp 33- 54.

Love, A. & Kruger, A. (2005). Teacher beliefs and student achievement in Urban schools serving African American students. *Journal of Educational Research*, Vol. 99(2), 87-98.

Marla, J. (2006). Impact of one science teacher's beliefs on his instructional practice. *Journal of Education and Human Development*, Vol. 1, issue 1, Online.

McGinnis, R., Kramer, S., Shama, G., Graeber, A., Parker, C., & Watanabe, T. (2002). Undergraduates' attitudes and beliefs about subject matter and pedagogy measured periodically in a reform-based mathematics and science teacher preparation program. *Journal of Research in Science Teaching*, Vol. 39(8), 713 – 737.

Meadows, L. & Koballa, M. (1993). Elementary teachers' beliefs about joining a professional science teachers organizations. *Journal of Science Teacher Education*, Vol. 4(4), 115 – 120.

Morely, L. and Rassol, N. (1999). School Effectiveness: Fracturing Discourse. London, Falmer Press.

Raizen, S. A., & Michelsohn, A. M. (Eds.). (1994). The future of science in elementary schools: Educating prospective teachers. San Francisco: Jossey-Bass.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, Vol. 57 (1), 1 - 22.

Simmons, P.E., Emory, A., Carter, T. Coker, T., Finnegan, B., Crockett, D., et al. (1999). Beginning teachers: Beliefs and classroom actions. *Journal of Research in Science Teaching* Vol. 36(8), 930 - 954.

Southerland, S., Gess-Newsome, J. & Johnston, A.(2003). Portraying science in the classroom: The manifestation of scientists' beliefs in classroom practice, *Journal of Research in Science Teaching*, Vol.40, 669 - 691.

Sweeny, A. E. (2003). Theory and Practice in Science Teaching. *Teachers and Teaching: theory and practice*, Vol. 9(2), 107 – 132

Tairab, H.(2003). The Role of Reflection in Facilitating Pre-service Primary School Teachers' Professional Growth. *Journal of Faculty of Education*, Year 18- Issue No. 20, 5- 25.

Thomas, J & Pedersen, E. (2003). Reforming Elementary Science Teacher Preparation: What about Extant Teaching Beliefs? *Science and Mathematics*, Vol. 103(8), 319 – 330.

Trowbridge, L., Bybee, R., & Powell, J. (2004). *Teaching Secondary School Science: Strategies for Developing Scientific Literacy*. Pearson Prentice Hall, New Jersey.