Students' perceptions of the effectiveness of their in-service training for the Advanced Certificate in Education programme

M. C. Ndlovu
Institute for Mathematics and Science Teaching (IMSTUS)
Faculty of Education
Stellenbosch University
e-mail: mcn@sun.ac.za

Abstract

The purpose of this study was to determine in-service students' perceptions of the effectiveness of the Advanced Certificate in Education (ACE) programme offered by Stellenbosch University, South Africa, in preparing them to be confident teachers of Mathematical Literacy, Life Sciences or Physical Sciences in the Further Education and Training (FET) phase. An open-ended questionnaire was administered at the end of the first year of the two-year mixed-mode part-time study. The university's standard student feedback questionnaire was administered during contact sessions. A Likert-type 5-point scale version of the initial open-ended questionnaire was designed and administered to the cohort after graduation. Findings were that there were process, content, contextual and outcomes aspects of the programme which were consistently positive and needed to be maintained. There were aspects that were initially perceived negatively or positively but sentiment changed after graduation. There were also aspects that were consistently perceived negatively and needed improvement.

INTRODUCTION

The purpose of this article is to describe the background to and model of the Advanced Certificate in Education (ACE), and to report on the students' perceptions of the effectiveness of three ACE streams, in Mathematical Literacy, Life Sciences and Physical Sciences, offered by Stellenbosch University (SU) through the Institute for Mathematics and Science Teaching (IMSTUS). This narrative is done against a background of research literature related to the ACE and with a view of improving the content and delivery mode in line with institutional self-audit and accountability expected by the Higher Education Quality Committee (HEQC) (CHE 2004).

The ACE at SU is a 120-credit two-year part-time (mixed-mode – face-to-face and distance education) continuing professional development programme for practicing teachers who want to improve their NQF 5 qualifications to NQF 6 status, to change subject area specialisation, or to access postgraduate studies. Wilmot (2004, 155) contends that state-initiated transformation imperatives, together with the enormous backlog of under-qualified teachers trained during the apartheid era, have resulted in an increase of in-service teacher training courses culminating in programmes like

the ACE being offered to retrain and/or specialise teachers in such areas of need as mathematics, science and technology.

The ACE streams at SU are offered in response to demand by the Western Cape Education Department (WCED) and/or national Department of Education (DoE). In practice this means that applicants must normally be selected by the WCED, but may also apply individually in order to register. At the individual level Fresen (2009, 1) indicates that teachers in SA are affected by the recent Occupational Specific Dispensation (OSD) document of the Education Labour Relations Council (ELRC) which requires that all practising teachers must meet the NQF 6 level by 2013 to be registered by the South African Council for Educators (SACE). Many of the SU students come from rural districts of the WCED. Since travelling distance is a major factor in the access to training for rural teachers, the contact sessions are offered during school holidays. A stream is offered, provided there is sufficient interest, usually a minimum of 20 students.

The contact sessions take place on campus and comprise of 175 hours per year, spread over five weeks (generally two weeks in January, one week in April and two weeks in June/July). The teaching is done jointly by IMSTUS and academic staff members of the Faculties of Science and Education at the University. The languages of instruction are English and Afrikaans, in dual medium mode. The curricula are structured to consist of 80 per cent subject content (with a continuous undertone of methodology) and 20 per cent didactical skills. The development of the computer skills for classroom use is also integrated into the programme.

The students in the ACE have to submit at least ten assignments during the course of the year. These assignments cover all aspects of the training and are assessed and returned to the students with extensive written feedback. In November the students write an examination on all the work done during the year. In order to make an impact on the classroom practice of the students, an IMSTUS facilitator visits every student at his/her school once a year. The classroom visits normally take the format of a lesson presented by the student, another lesson presented by the facilitator to a class of that student, followed by a discussion of the lessons between the facilitator and the student in a collaborative manner. A meeting is then held with the subject team within which the student operates in the school.

Teacher quality (as measured by skills, knowledge and qualifications) plays a decisive role in students' progress in an educational system (Barber and Mourshed 2007; Hanushek 2003; Onwu 2000; Varga et al. 2007). Reflecting on the SA situation, it is clear that there is a huge teacher quality gap, more so in the critical subject areas of mathematics and science. The Minister of Basic Education, Motshekga (*Cape Argus* 2010), conceded that 1 700 South African teachers are unqualified to teach at secondary schools. While matriculation pass rates had previously been improving up to 2003, there was still a serious lack of higher-grade (HG) passes in mathematics and science (Naidoo 2007, 34). Even more recently, a pattern of steady decline in the pass rate in mathematics and science has been persistently observed (Motshekga 2010, Forde 2010). The education system cannot, therefore, supply the numbers of

skilled black teachers required to meet the state's employment-equity aspirations with attendant black economic empowerment setbacks (Naidoo 2007). This is especially true of skills based on mathematics and science. The national 2009 matriculation results showed that 60 percent of candidates who wrote the Physical Sciences examination scored less than 40 percent. Meanwhile the DoE has acknowledged that mathematics and science education in SA's high schools is in a very poor state (*Cape Argus* 2010).

Accordingly, the primary focus of this study was to gauge the mathematics and science students' perceptions of the effectiveness of the ACE streams in equipping them to be confident practitioners of Mathematical Literacy, Life Sciences or Physical Sciences education in the FET Phase. The broad research question was thus to evaluate if the current model (content, context and processes) of in-service training meets the needs and expectations of the participating students in relation to the outcomes of the course. More specifically: What are the students' perceptions of the effectiveness of the instructional processes, content and contexts during training? What are the students' perceptions of the effectiveness of the instructional processes, content and contexts after graduating? How do students' perceptions after graduating compare with those during training?

LITERATURE REVIEW

Evaluating the success of an educational program is a fundamental form of institutional self-evaluation and accountability. However, research on the impact of mixed-mode educational programs is sparse (Fahy, Spencer and Halinski 2007). A survey of the literature on the generic level shows that most work in this area focuses on individual aspects of the mode of delivery (Aluko 2009). For instance on the impact of new technologies on distance learning (Keegan et al. 2008), types of web-study designs (Engelbrecht and Harding 2005), mentor perceptions of mentoring (Mukeredzi et al. 2009), improving teaching practices among in-service teachers undertaking a distance-education programme (Aldridge et al. 2009)**.** Very few studies focus on the totality of a program or in particular on the professional practice of teachers (Stols, Olivier and Grayson 2007), let alone on mathematics and science in-service teacher education.

Several studies on the ACE programmes have been undertaken but are few and far between. Gierdien (2008) reports on what teachers in an ACE in-service programme learned about probabilistic reasoning in relation to teaching it. Findings revealed a complicated picture, where some teachers were prepared to consider influences of their intuitive probabilistic reasoning on formal probabilistic reasoning when it came to teaching. Schudel et al. (2008) report on experiences in the ACE (Environmental Education) courses of two SA universities focusing on whole school approaches. They identified two different approaches to contextual profiling: *a priori* contextual profiling and contextual profiling within courses and within context. From these few local studies it is clear that the focus has been on researchers' perspectives and

interpretations. Yet students' evaluation of educational programmes is a useful way of monitoring consumer usage as they are the best assessors of their own learning (Cassimjee 2007, 412). That is, by creating regular opportunities for the voices of students to be heard, their perspectives may inform the desired programme development (Cornelissen and Van Wyk 2007, 832).

Aluko (2009), however, examined the impact of an ACE (Education Management) programme, on the professional practice of teachers as reported by graduates and their school principals. Findings revealed that the program was beneficial to graduates' personal development, professional practice, schools, learners, and colleagues. Principals further attested to the differences they observed between the graduates and other teachers who had not been exposed to such a programme. Morabe (2004) conducted a pre-test-post-test survey on attitudes towards chemistry and chemistry teaching involving 37 science educators registered for an ACE. The study suggested that a well-designed teacher in-service program can positively influence the attitude of educators towards science. However, neither study examined perceptions of self-efficacy in the context of subject knowledge and subject didactical skills.

Further afield, the 2005 Organisation for Economic Co-operation and Development (OECD) report, based on an analysis of teacher training policies in 25 countries, concludes that teacher quality is the single most important factor in an education system (Karpati 2009). The conclusion affirms that the quality of an education system cannot exceed the quality of its teachers irrespective of how up-to-date their technology or programmes are (Barber and Mourshed 2007; Kahle 1999). Sustainable improvement of mathematics and science achievement, therefore, rests on strengthening teacher competencies. In other words, mathematics and science teacher professional development should simultaneously address content knowledge, teaching approaches and professional attitudes (Kriek and Grayson 2009). Yet teachers' own practical needs and expectations about the quality of their training vis-à-vis their expectations have seldom been researched (Bayrakci 2009; Karagiorgi and Symeou 2007). This gap in research overlooks Kirkpatrick and Kirkpatrick's (2006) educational training programme evaluation model which prioritises customer satisfaction.

Guskey and Sparks (1996) (as cited by Rogers et al. 2010, 310), proposed a model of professional development (PD) design and evaluation based on the premise that the quality of PD is influenced by content, context, and process factors. Content factors in the ACE at Stellenbosch University include the subject content knowledge and didactic skills to be developed in students to be able to enact the knowledge, skills, values and attitudes expected by outcome-based education (OBE), or whatever might succeed it, in the mathematics and science classrooms. Context factors include the 'who, when, where, and why of professional development' (Guskey 2000, 74). Process refers to the PD delivery format and instructional strategies. These factors are key to understanding the outcomes of PD (Abell et al. 2007) and, in our case, the outcomes of the ACE programme.

Enkenberg (2001) argues that knowledge acquisition and participation are the two prominent metaphors that guide our thinking about learning and relevant instruction. The first of them represents an individual and the second a social basis of learning. Problem-based learning, case-based teaching, learning by design and cognitive apprenticeship are discussed and positioned powerfully emphasizing anticipation and participation as main goals and perspectives of instructional design. This instructional design approach is compatible with socio-constructivist, project-based, inquiry-based, activity-based or problem-centred learning approaches in mathematics and science education espoused at IMSTUS.

RESEARCH METHODOLOGY

Samples

In this pilot evaluation research study an open-ended questionnaire was administered to 38 (19 males, 19 females) students in the three ACE streams administered by IMSTUS. Table 1 shows the sample characteristics.

Table1: Gender distribution of sample by distance travelled to SU

Distance in km	0 <d<50		50<d<100		100<d<200		dist>200		Total	
Sex	M	F	M	F	M	F	M	F	M	F
Total	9	9	4	4	2	3	4	3	19	19

The same questionnaire was restructured into a Likert scale type version and 11 of the original 38 ACE students responded after graduating. Table 2 shows the distribution by stream and gender.

Table 2: Sample distribution of ACE graduates by stream and gender

Subject	Life Sciences		Physical		Math Literacy		Total	
Sex	M	F	M	F	M	F	M	F
Sub totals	2	3	2	1	2	0	6	4
Grand Totals	5		3		2		10	

The students' evaluations of their own learning during contact sessions were considered in terms of questionnaire response statistics in Table 2.

Data collection

Data collection was done at three different stages, using two different research instruments. In the first stage, data in connection with the ACE student teachers were collected towards the end of the first year of study using an open-ended questionnaire as a research instrument. In the second stage, data were collected during contact sessions using the university's standard feedback questionnaire. At the third stage,

the initial open-ended questionnaire was converted to a 5-point Likert-type semantic scale and distributed to the graduates by fax and e-mail. The questionnaire asked students to express their opinions regarding various aspects of the programme and changes that occurred in their own and their learners' knowledge, skills and attitudes.

Table 3: Distribution of sample ACE students by contact session, gender and stream in 2008/9

Contact Session	Males	Females	Total
Life Sciences April 2008	11	16	27
Life Sciences April 2008	5	9	14
Life Sciences, May 2008	6	10	16
Life Sciences Jan 2009	8	12	20
Life Sciences, Feb 2009	4	12	16
Physical Sciences May 2008	13	4	17
Physical Sciences June 2008	11	6	17
Physical Sciences Feb 2009	15	7	22
Mathematical Literacy April 2008	6	13	19
Mathematical Literacy May 2008	14	15	29
Mathematical Literacy July 2008	5	10	15
Mathematical Literacy Jan 2009	6	15	21
Mathematical Literacy July 2009	10	11	21

RESULTS AND DISCUSSION

Quantitative results of open-ended questionnaire

Given the qualitative nature of the responses, there was need to use different raters to ascertain inter-rater reliability. Three raters scored the open-ended questionnaire responses independently on a 5-point Likert scale obtaining Cronbach alpha, Split-half (odd-even) correlation coefficient and Spearman-Brown prophecy, mean scores and standard deviation values as shown in Table 4.

Table 4: Inter-rater comparison of internal consistency on the 5-point scale

Statistical Index (N = 38)	Rater 1	Rater 2	Rater 3
Cronbach's alpha reliability coefficient	0.677	0.647	0.500
Split-half (odd-even) correlations	0.589	0.486	0.518
Spearman-Brown Prophecy	0.742	0.654	0.682
Mean Score	94.90	102.4	97.05
Standard Deviation	6.315	7.447	4.701

When the 5-point Likert scale was collapsed to 3-points an inter-rater (Fleiss kappa) reliability coefficient of 0.784 was obtained falling within an acceptable correlation range.

Rater 2's ratings were adopted for further analysis because the Cronbach Alpha obtained was the median of the three raters. The Cronbach's alpha indicated that the reliability coefficient for the 25 questions was relatively low. Although there is no definitive cutoff point for rejection/acceptance, a reliability coefficient of 0.7 or more is generally considered acceptable (only) as a rule of thumb (George and Mallery 2003;). Gliem and Gliem (2003, 87) concur when they reiterate that although Cronbach's alpha reliability coefficient normally ranges between 0 and 1 there is actually no lower limit. Nevertheless, the closer the coefficient is to 1.0, the greater the internal consistency of the items in the scale. The Split-half (odd-even) Correlation coefficient is considered less reliable than the Cronbach's alpha in that it is affected by how the items are grouped whereas the latter is the mean of all possible split-half groupings.

Table 5: Summary Statistics for students at end of Year 1 and after graduation (Year 2)

Statistic (Index) (N = 38)	Value if all Q's kept for		Value if Q7 deleted		Value if Q 7 & 8 deleted	
	End of Year 1	After Year2	End of Year 1	After Year2	End of Year 1	After Year2
Cronbach's alpha reliability coefficient	0.647	0.770	0.704	0.748	0.718	0.724
Split-half (odd-even) correlations	0.486	0.458	0.589	0.444	0.628	0.503
Spearman-Brown Prophecy	0.654	0.628	0.741	0.615	0.771	0.669
Mean Score	102.42	105.5	99.47	101.7	96.18	97.80
Standard Deviation	7.447	5.481	7.660	5.235	7.629	4.791

Table 5 summarizes these statistical indices while Table 6 shows the mean score for each of the 25 questions per ACE stream: Life Sciences (N=18), Physical Sciences (N=7) and Mathematical Literacy (N=13), at the end of Year 1, and N=11 after graduation (end of Year 2). Gliem and Gliem (2003, 88) insist that although it is imperative to calculate and report Cronbach's alpha coefficient when using Likert-type scales, item analysis should use summated scales or subscales and not individual items as commonly wrongly done. In view of this plea for caution, the last but one column in Table 6 represents the (summated) Cronbach's alpha coefficient with the item 'deleted'. When Question 7 (on satisfaction with transport arrangements) was deleted Cronbach's internal consistency reliability coefficient increased for the end of Year 1 but decreased after graduation. The deletion of both Questions 7 and 8, which are beyond the control of IMSTUS, yielded a Cronbach's alpha increase at the end of Year 1 and a decrease after graduation. The corresponding Split-Half correlations and Spearman-Brown Prophecies are shown in Table 4.

Table 6: Individual item analysis by overall mean rank order

	Question	Life Sci %	Phy Sci %	Math Lit %	Weighted Overall % Mean	Alpha if Question deleted	ACE grad %
16	The confidence with which I teach improved	94	91	92	93	0.64	86
25	My own attitude towards the teaching profession has changed for the better	88	97	95	92	0.64	92
9	Teaching facilities at SU are suitable	93	89	88	91	0.65	88
24	My relationship with educators from other schools teaching the same subject has improved	88	86	97	91	0.64	80
11	My understanding of OBE improved (in terms of learner-centredness, continuous assessment, etc)	94	74	91	89	0.63	90
22	My learners' enthusiasm/participation/attitude/ interaction in my subject has improved	86	91	94	89	0.64	82
13	My subject content knowledge increased	91	86	88	89	0.63	94
17	Creativity in offering my subject increased	92	89	85	89	0.63	84
21	The way I manage my classes has improved	87	86	92	88	0.64	84
1	Holiday contact time is convenient for my circumstances	88	80	92	88	0.60	90
14	My practical skills to teach the subject improved	87	86	91	88	0.65	88
15	My subject didactical skills improved	91	80	86	87	0.64	88
19	My contribution to subject meeting/cluster meetings has improved	88	80	91	87	0.63	78
12	My implementation of OBE improved	87	80	89	86	0.62	86
20	The way I see my professional development has improved	89	80	85	86	0.61	84
18	The way my colleagues/subject advisor/principal perceive me has improved	88	74	86	85	0.64	72
23	My learners' academic achievement in the subject has improved	81	80	88	83	0.64	72
4	Different lecturers in a subject meet my expectations	83	66	85	81	0.65	82
10	Individual classroom visits are valuable	81	71	83	80	0.63	88
3	The use of contact time meets my particular needs	60	69	88	71	0.61	84
5	Assignments meet my expectations and ability	64	83	74	71	0.67	84
8	Accommodation arrangements are suitable	62	69	69	66	0.66	78
2	The amount of contact time meets my particular needs	56	49	72	59	0.62	82
6	Examinations match course content	50	74	65	59	0.62	98
7	Transport arrangements are suitable	57	54	65	59	0.70	78
	Mean per ACE Stream (+Overall)	81	79	85	82	N/A	84

When the same open-ended questionnaire was restructured into a closed Likert-type questionnaire and administered to the same cohort of ACE students after completing the programme (N=11), the mean (%) scores in the last column of Table 6 were obtained. The overall mean score for Physical Science was the lowest while that for Mathematical Literacy was the highest. The overall mean score for all the ACE streams put together indicates an approval rating.

Combined qualitative and quantitative results of initial open-ended and post graduation Likert-scale type questionnaire

Satisfaction with Holiday Contact time: The convenience of school holiday contact sessions was perceived positively by the majority of the students (c.f. mean of 88% during training and 90% after graduating) who described them as 'acceptable', 'better than weekends', 'suit me well', 'preferable to weekends or evenings', etc. Reasons given for preference of holidays included: 'advantage that more could be done that time', 'long distance from SU', 'holidays work better because of too many responsibilities at school', 'better focus on studies, while weekends overlap too much with school work'. Table 1 shows distances students had to traverse in order to attend the contact sessions. Transport and accommodation arrangements were perceived negatively but both were beyond the control of the university in that they were determined by the WCED.

Satisfaction with the duration and utilization of Holiday Contact time: The majority of students were initially dissatisfied with the amount of contact time. Students described the time as 'hopelessly too long, difficult to stay focused all day', 'too short, too spread out', 'not enough, the sessions are too long'. Students were moderately satisfied with the utilization of contact time describing it as: 'acceptable', 'used optimally'. The use of different lecturers was perceived positively by the majority of students as: 'an advantage since lecturers have different approaches', 'acceptable, since each lecturer is a specialist'. A minority blamed the use of different lecturers for 'causing confusion since each lecturer has a different method'. (NB: take into account different learning styles)

Satisfaction with assignments, examinations and lesson observation visits: A moderate majority of students felt that assignments were important in that 'they prepare one for exams, without assignments, distance learning will fail', 'not too many, level of difficulty satisfactory, 'assignments are a fair reflection of the scope of work covered'. The dissatisfied minority complained mainly about limited 'time to complete them during the school time', and recommended to 'spend two evenings at campus working on them'. Mattson (2006, 56) acknowledges that although many more teachers can be trained through field-based models one of the main challenges is 'finding time to study and reaching a balance with other life priorities'. Aluko, Fraser and Hendrikz (2008) point out that although distance learning creates challenges for and arouses concern among many in the higher education community, it is in many ways a welcome phenomenon.

Examinations were initially viewed negatively with the weight of opinion against 'too much work for too little marks', 'too much content to be studied for each paper', 'taken under great pressure as the Grade 12 moderation took place', 'no previous examination papers made available', and a call for 'papers to be evenly spaced' or a 'study leave compromise to be sought from the WCED'. One student did not think the exams were necessary arguing that 'tasks and tests during the contact times

should be enough'. However, after graduation, examinations were strongly viewed in positive light.

Lesson observation visits by lecturers were generally viewed positively (both during and after training) and reckoned to be 'developmental in terms of classroom practice' and 'encouraging and motivational to improve oneself', 'the lecturers were supportive'. A few students felt 'classroom visits for marks are not necessary but demonstration lessons are welcome', 'not necessary, we have to be assessed for Integrated Quality Management System (IQMS) purposes at least twice a year already' or 'didn't receive the announcement on time, miscommunication at the school'.

Satisfaction with understanding and implementation of OBE: The majority of students (both before and after graduation) felt their understanding and implementation of OBE had improved significantly as the following comments indicated: 'enhanced and complemented existing experience', 'OBE understanding has improved, I learnt a lot of different assessment strategies', and 'everything falls into place now'. However, some students expressed guarded optimism or outright pessimism: 'it improved as the year went by but there is still uncertainty concerning the curriculum', 'I am not a great believer of the education system but I implement it as it is part of my work', 'it is still a problem, because I am teaching 50 to 60 learners in a class and learner behaviour is a problem'. The complexity posed by large class sizes is acknowledged by Schulman (2000, 133) when he points out that one reason for the difficulty in the internalization of learning is that 'teachers do not often typically face a one-on-one clinical interaction in the classroom, but responsibility for 30 or 35 or 40 students'. This is an understatement of the situation described by educators in SA. Rogan and Grayson (2003) similarly note that large scale educational programmes (such as the OBE driven Curriculum 2005 and the Revised National Curriculum Statements in SA) often achieve low outcomes as a result of poor implementation of what was essentially a good idea. Good implementation can only come about if teachers know what is expected of them and favourable conditions and resources are created and availed for successful implementation.

Subject knowledge and didactic skills: Most students felt that their subject content knowledge had improved significantly as is evident in remarks such as: 'improved dramatically', 'gained a lot especially on evolution', 'improved a lot because mathematics is very theoretical but ... I bought a house and understood a lot of the paper work'. (Tangible real life value to the student). A few students felt there was: 'too much information to grasp in a short time, but definitely got there'.

Positive changes (both before and after) in practical skills, subject didactics, confidence and creativity were evidenced by comments such as: 'my skills have been polished', 'I have acquired different teaching strategies', 'I have more self confidence when presenting a lesson', 'I have now more tools to create and to be creative in Life Sciences', 'I think even my learners have noticed that I am studying somewhere because of my creativeness'. (The latter student recognizes that learners are critical evaluators of his teaching). The teachers thus developed a positive sense

of self-efficacy in their teaching competences. Chang, McKeachie and Lin (2010, 209) define self-efficacy in Bandura's terminology as 'people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances'. However, not all students (during training) were content as evidenced by comments such as: 'too much emphasis on subject matter', 'my creativity needs to improve', 'I can be a bit more creative but there are certain contextual factors that stop me, like big classes'. Teachers' beliefs in their capabilities has a direct influence in what mathematics or science content they are going to teach and how confidently/effectively/creatively they are going to teach it.

Satisfaction with learner participation and achievement: The majority of students felt that their ability to involve learners in the learning process had improved, expressed through comments like: 'learners have become more enthusiastic/confident in participating', 'excited about Life Sciences', 'the number of learners doing mathematics and science has increased a lot'. Some students made a differentiation between grades: 'the grade 12 learners were awesome, really enjoyed my lessons, grade 11s were enthusiastic but grade 10s struggled', 'differs from class to class because my classes have such large numbers, it is difficult always implementing the group work which was so ... stressed during the course', 'it's just a pity some of the learners lack discipline'. (c.f. UN denials of class size effect here).

During training most students felt that their learners' academic achievement had improved: 'I can clearly see the improvement in my Grade 12 class, I taught completely differently in the 3rd and 4th quarters than ... the 1st and 2nd', 'learner achievement has definitely improved'. However, some were noncommittal citing: 'still too many external factors influencing the learning process', 'level of learner responsibility low and achievement average', 'success won't be obvious immediately'. It is surprising that after graduating teachers doubted their impact on learner performance even more.

Satisfaction with professional development: Most of the students viewed their professional development positively. However, some were reserved about the principals' perceptions of their professional development or reported limited opportunities for interacting with peers in other schools. This means that teachers do not benefit much from peer support, which Chang, Mckeachie and Lin (2010, 217) found to be the highest contributing factor towards teaching efficacy. Colleagues from the same department at school or from the same discipline in a district can share teaching strategies helpful in dealing with areas that need improvement leading to tremendous collective professional growth in classroom practice and expertise. That entails the development of role identity and commitment through involvement with role incumbents as envisaged by Cornelissen and Van Wyk (2007, 831) culminating in a positive status identification or professional self-image, so often lacking in the teaching profession.

Students' feedback on contact sessions

The student teachers' responses to the university's standard feedback questionnaire are summarized in Table 7. The questions sought feedback on the relevance, clarity, readability, and intellectual challenge of the course materials; workload; relevance, interactivity and practical orientation and value of instruction and exercises; relevance of assignments and tests; and an evaluation of accessibility/availability of learning facilities such as the library, science laboratories and computer rooms; a declaration of the students' commitment to the course; and overall perception of the degree of difficulty of the course(s) offered in the programme streams. The questionnaire also sought open-ended responses regarding the degree of difficulty of the courses, administrative arrangements, and lecturers' performance, among other things.

Table 7: Students' feedback on courses delivered during contact sessions

	Question	Life Sci	Phy Sci	Math Lit	Overall Mean
10	I worked very hard at this course	88	89	87	88
5	I greatly benefited from the teaching	87	92	85	87
11	I am capable of making a success of this course	87	88	86	87
12	Overall, I enjoyed the course very much	87	90	79	85
2	The material is relevant and practically orientated	83	90	80	84
15	My overall evaluation of the course is positive	86	90	80	84
3	The material is interesting and intellectually stimulating	83	90	80	83
6	Assignments/problems set are relevant to the course	84	89	79	83
7	Set assignments/problems are of practical value	83	88	79	83
13	Class exercises and/or practicals are practically orientated	84	89	79	83
1	The set textbook(s) and other materials are clearly written and easily understood	80	85	77	80
8	The feedback from tests and assignments enabled me to assess my progress in the course	77	85	76	79
16	The university facilities such as the library, laboratories and computer rooms are freely available	80	73	80	78
9	I had the necessary background knowledge to enable me to follow the course	79	81	71	76
14	Overall, the course's degree of difficulty is reasonable	76	81	71	75
4	The amount of work is reasonable	72	79	68	72
	Mean per ACE Stream (+Overall)	**82**	**86**	**78**	82

The table shows that the students felt strongly that they had worked very hard, benefited greatly from the programme, were capable of making a success of the course, enjoyed the course very much, the course materials were 'intellectually stimulating', assignments/tasks given were relevant and of practical value. Consequently their overall evaluation of the course(s) was positive and correlated with the ratings

given both during and after graduation. Areas that students were least satisfied with included: excessive workload for full time teachers; inadequate background knowledge on certain topics, and difficulty of the course content, e.g. biochemistry, pure mathematics, plant physiology/anatomy/morphology, genetics, etc. Again this correlated with the concerns raised in the initial open-ended questionnaire.

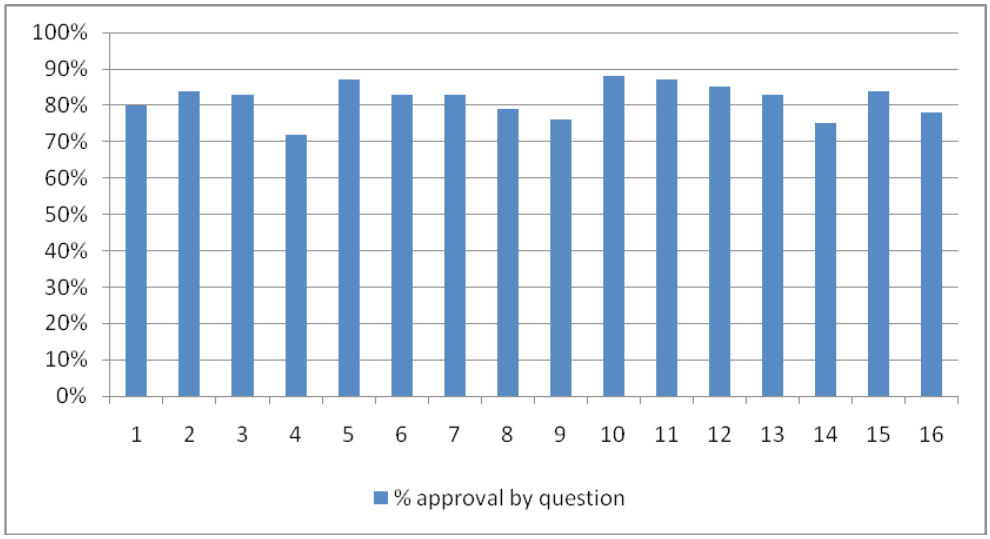

Figure 1: Student feedback during course

The students were also less satisfied with assignments/exercises and tests attesting, familiarly, that there 'were too many, in a short time'. The accessibility of university facilities such as the library, laboratories and computer rooms was a cause for concern, especially during the January vacation periods when the university is still closed. The students were, however, confident that they were putting enough effort themselves, capable of making a success of the course and enjoyed the course. Positive self-evaluations did not come as a surprise as self-serving bias could also have played a role. Berkhout (2006, 572) argues that qualifications serve to shape individuals' perceptions of their own worth. A stream by stream analysis (Table 4 and Figure 2) shows that students in the Physical Sciences stream were most satisfied overall while those in the Mathematical Literacy stream were the least. This contradicted earlier findings in the open-ended questionnaire where students in the Mathematical Literacy stream were the most satisfied and those in the Physical Sciences stream the least. A chi-square test in both instances showed that the differences in satisfaction levels were statistically insignificant.

The students appreciated the lecturers' level of expertise as evinced by comments such as: 'quite knowledgeable about their subjects and willing to share information', 'Dr X supplied us with very good content', 'Dr Y, very good lecturer, privileged to be taught by him'. However, some of the students bemoaned some lecturers'

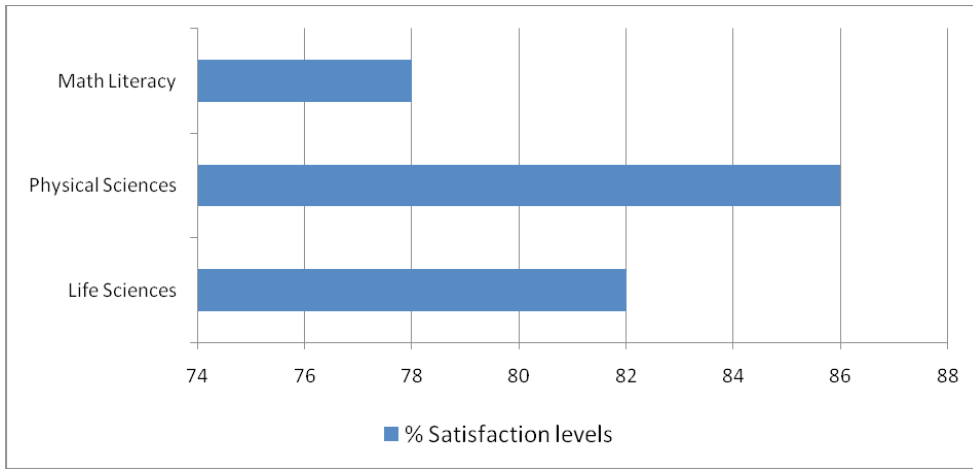

Figure 2: Stream by stream analysis of satisfaction levels

use of a language of instruction that they did not understand thus impeding their understanding as shown by such comments as: 'Some (lecturers) use Afrikaans more, which creates problems for third language speakers of Afrikaans', 'some students ask questions in Afrikaans and lecturers answer in Afrikaans without interpreting for us', 'some lecturers quickly switch to English yet it was said the course would be a dual medium'. The language of instruction is a vehicle of epistemological access. Overall, however, the satisfaction levels of 81 per cent at the end of the first year, 82 per cent during contact sessions and 82 per cent after graduating were ostensibly consistent.

CONCLUSIONS AND RECOMMENDATIONS

Content, processes, contexts and outcomes consistently in need of consolidation

From the results of the research effort it is clear that the students were consistently positive about gains in subject content knowledge, pedagogical skills (didactic skills, practical skills, class management skills, and understanding of OBE) and own attitude towards the profession. These content and process areas form the core of the ACE outcomes and fit well in Ling's (2003) professional development model which emphasizes that social development, subject knowledge development, pedagogical development and cognitive development should underpin our conceptualization of teachers' field experience.

The use of school holidays was preferable for most students and this preference was logical in a context where they had to both study and simultaneously remain in fulltime employment. The value attached to vacation sessions was in line with international trends where distance education is expected to grow modestly (Schmidt

et al. 2000) in future or where any sound distance programme has to be blended with face-to-face tuition. The university, therefore, has to continue availing its facilities, a contextual factor which has been consistently rated positively.

Content, processes, contexts and outcomes consistently in need of improvement

It was however disconcerting to note that the students remained pessimistic about their perceived impact on learner achievement citing too many other contextual factors at play at the school level. That so many factors impinged on the learning process was undoubted. However students needed to realize that as teachers, they are the backbone of the education system. It was equally disconcerting to note that administrative (contextual) issues relating to transport and accommodation arrangements were consistently perceived negatively. The amount of contact time has also been consistently rated as inadequate. This suggests that optimum use of contact sessions is imperative. In contrast to Aluko's (2009) findings, it is regrettable that students consistently felt undervalued by colleagues and supervisors. Having obtained an NQF 6 qualification, with the attendant monetary benefits, one would legitimately have expected improved status. If the ACE qualification elevates educators to a status equivalent to a degree holder, why should it not be certificated and recognized as a degree? How can the career prospects of ACE graduates be enhanced to reward those who complete the programme? Perhaps these are contextual questions for the DoE to ponder.

Discrepancies between pre-qualification and post-qualification perceptions

It is surprising that examinations which were viewed very negatively when they were still pending are then viewed very positively after they been taken. This might be area for further investigation. Examinations are independent responses to tasks and are a more accurate measure of knowledge gains. An improvement in the spacing of examination papers appeared to be a legitimate recommendation and had already been adopted by the completion of the study. The perceptions about the ability to implement OBE successfully remain mired in other intervening factors such as class sizes, learner indiscipline, limited resources and doubts about the solidity of its foundations and political overtones. Class visits by lecturers were also received with mixed feelings. One dilemma was that, on the one hand, there are degreed teachers who are obtaining the ACE as a professional qualification, in which case class visits are justified. On the other hand, those who are qualified teachers already

see class visits as redundant. This lends the ACE with some status ambiguity – is it a pre-service or in-service (continuing professional development – CPD) course?

Limitations of the study

The study has been limited to the students' perceptions, which leaves open an investigation into other stakeholders' perceptions.

Fitness of purpose, value for money and expected outcomes

Revisiting the outcomes of the ACE as enunciated by the DoE one notices that there are two tiers of outcomes. At the level of the university students are expected to demonstrate mastery of subject matter, didactic skills (general and domain specific), creativity and criticality, knowledge and promotion of outcome-based education principles, and to select, design and/or use appropriate assessment instruments and procedures (Stellenbosch University 2006, 12–13). For the purpose of these outcomes, we can conclude that the students' expectations were satisfied. However, the programme falls short on the DoE's additional expectation that the graduates will be able to get involved in research and be exposed to lifelong learning.

At the individual level the ACE leads to salary and professional qualification adjustments, which implies that the teachers benefit monetarily and status wise by investing in the ACE. That more learners are likely to be taught by better qualified mathematics and science teachers is in the national interest.

ACKNOWLEDGEMENTS

The author is extremely grateful to the inputs and suggestions from the Director of IMSTUS, Dr. Kosie Smith, and his staff who made this article possible.

REFERENCES

Abell, S. K., J. K. Lannin, R. M. Marra, M. W. Ehlert, J. S. Cole, M. H. Lee et al. 2007. Multi-site evaluation of science and mathematics teacher professional development programs: The project profile approach. *Studies in Educational Evaluation* 33:135–158.

Aldridge, J., B. Fraser and S. Ntuli. 2009. Utilising learning environment assessments to improve teaching practices among in-service teachers undertaking a distance-education programme. *South African Journal of Education* 29:147–170.

Aluko, F. R., W. J. Fraser and J. Hendrikz. 2008. Some interfaces in conventional and distance education programmes in a postmodern context. *South African Journal of Higher Education* 22(3): 484–497.

Aluko, R. 2009. The impact of an Advanced Certificate in Education (ACE) program of the professional practice of graduates. *International Review of Research in Open and Distance Learning* 10(4): 1–25.

Barber, M. and M. Mourshed. 2007. *How the world's best performing school systems come out on top*. McKinsey & Company.

Bayrakci, M. 2009. In-service teacher training in Japan and Turkey: A comparative analysis of institutions and practices. *Australian Journal of Teacher Education* 34(1): 10–22.

Berkhout, S. J. 2006. The qualifications business in higher education. *South African Journal of Higher Education* 20(5): 572–581.

Cape Argus. 2010. 1700 teachers unqualified. *Cape Argus.* 4 May.

Cassimjee, R. 2007. An evaluation of students' perceptions of the use of case-based teaching and group work in a first-year nursing programme. *South African Journal of Higher Education* 21(3): 412–428.

Chang, T., W. McKeachie and Y. Lin. 2010. Faculty perceptions of teaching support and teaching efficacy in Taiwan. *Higher Education* 59:207–220.

CHE, see Council on Higher Education.

Cornelissen, J. J. and. A. S. Van Wyk. 2007. Professional socialization: An influence on professional development and role definition. *South African Journal of Higher Education* 21(7): 826–841.

Council on Higher Education. 2004. *Criteria for institutional audits: Higher Education Quality Committee*. Pretoria: CHE.

Engelbrecht, J. and A. Harding. 2005. Teaching undergraduate mathematics on the Internet. *Educational Studies in Mathematics* 58:235–252.

Enkenberg, J. 2001. Instructional design and emerging teaching models in higher education. *Computers in Human Behaviour* 17:495–506.

Fahy, P. J., B. Spencer and T. Halinski. 2007. The self-reported impact of graduate program completion on the careers and plans of graduates. *Quarterly Review of Distance Education* 9(1): 51–71.

Forde, F. 2010. Matric failure rate: It's worse than it seemed. *The Sunday Independent*. 17 January.

Fresen, J. W. 2009. Designing to promote access, quality and student support in an Advanced Certificate programme for rural teachers in South Africa. *The International Review of Research in Open and Distance Learning* 10(4): 1–20.

George, D. and P. Mallery. 2003. *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed). Boston: Allyn & Bacon.

Gierdien, F. 2008. Teacher learning about probabilistic reasoning in relation to teaching it in an Advanced Certificate in Education (ACE) programme. *South African Journal of Education* 28:19–38.

Gliem, J. A. and R. R. Gliem. 2003. Calculating, interpreting, and reporting Cronbach's Alpha reliability coefficient for Likert-type scales. Available at: https://scholarworks.iupui.edu/handle/1805/344.

Guskey, T. 2000. *Evaluating professional development*. Thousand Oaks, CA: Corwin Press.

Hanushek, E. A. 2003. The failure of input-based schooling policies. *Economic Journal* 113 (February): 64–98.

Kahle, J. B. 1999. Teacher professional development. Available at http://gos.gos.sbc.edu/k/kahle.html.

Karagiorgi, Y. and L. Symeou. 2007. Teachers' in-service needs in Cyprus. *European Journal of Teacher Education* 30(3): 195–216.

Karpati, A. 2009. Teacher training and professional development. Greenbook: IL External Conditions for Renewal. In *Greenbook for the renewal of public education in Hungary,* eds. H. Fazekas, J. Kollo and J. Uarga, 203–226. Budapest: ECOSTAT. Available at: http://oktatas.magvarorszagholnap.hu/wiki/Green_Book.

Keegan, D. Kismihok, B. Kramer, N. Mileva, B. Simpson and B. Vertecchi. 2008. Bibliography on the impact of new technologies on distance learning students. Available at: http://www.lapes.it/lps1\2/sito/progetti/leonardo/impact_ bibliography_en.pdf.

Kirkpatrick, D. L. and J. D. Kirkpatrick. 2006. *Evaluating training programs*. Third edition. San Francisco, CA: Berret-Koehler Publishers

Kriek, J. and D. Grayson. 2009. A holistic professional development model for South African physical science teachers. *South African Journal of Education* 29:185–203.

Ling, L. Y. 2003. Underpinnings of teachers' professional development – a new conceptualization of field experience. *Asia Pacific Education Review* 4(1): 11–18.

Mattson, E. 2006. *Field-based models of primary Teacher Training: Case studies of student support systems from sub-Saharan Africa.* Cambridge: International Research Foundation for Open Learning (IRFOL).

Morabe, O. N. 2004. The impact of the SEDIBA project on the attitude of participating educators towards chemistry and chemistry teaching. M.Ed. dissertation, North-West University.

Motshekga, A. 2010. Some papers were harder. *Sunday Times*. 17 January.

Mukeredzi, T. G., G. T. Ndamba and Z. L. Weda. 2009. Teacher development through distance education: Mentor perceptions of mentoring. *South African Journal of Higher Education* 23(2): 340–355.

Naidoo, B. 2007. Below par maths and science teaching economic strain. Available at:htttp://www.engineeringnews.co.za/article/below-par-maths-and-science-teaching-x-learning-economic-strain-2007-11-16.

Onwu, G. O. M. 2000. How should we educate science teachers for a changing society? *South African Journal of Higher Education* 14(3): 43–50.

Rogan, J. M. and D. J. Grayson. 2003. Towards a theory of curriculum implementation with particular reference to science education in developing countries. *International Journal of Science Education* 25(10): 1171–1204.

Rogers, M. A. P., S. K. Abell, R. M. Marra, F. Arbaugh, K. L. Hutchins and J. S. Cole. 2010. Orientations to science teacher professional development: An exploratory study. *Journal of Science Teacher Education* 21:309–328.

Schudel, I., C. le Roux, H. Lotz-Sisitka, C. Loubser, R. O'Donoghue and T. Shallcross. 2008. *South African Journal of Education* 28:543–559.

Schmidt, S., M. C. Shelley and M. Van Wart. 2000. The challenges to distance education in an academic social science discipline: the case of Political Science. *Education Policy Analysis Archives.*

Schulman, L. S. 2000. Teacher development: Roles of domain expertise and pedagogical knowledge. *Journal of Applied Developmental Psychology* 21(1): 129–135.

Stellenbosch University, 2006. *Advanced Certificate in Education (Mathematical Literacy)*. Stellenbosch.

Stols, G., A. Olivier and D. Grayson. 2007. Description and impact of a distance mathematics course for grade 10 to 12 teachers. *Pythagoras* 65(June): 32–38.

Varga, A., M. Fu Koszo, M. Mayer and W. Sleurs. 2007. Developing teacher competences for education for sustainable dev elopement through reflection: The Environmental School Initiatives approach. *Journal of Education for Teaching* 33(2): 241–256.

Wilmot, D. 2004. Emerging models of teacher training: The case of South Africa. *International Research in Geographical and Environmental Education* 32(2): 153–158.