DETERMINING THE NEED FOR A POSTGRADUATE QUALIFICATION IN FIRE TECHNOLOGY

E.J. SMIT AND S. P. VAN TONDER

ABSTRACT

In South Africa (SA) fire service employees train at accredited training centres to become qualified firefighters, but to progress to higher leadership positions, there is a perceived need to acquire advanced expertise in areas that could be addressed by Higher Education (HE). A study employing a survey and focus group discussion was conducted, in collaboration with the professional body for emergency services in SA, to ascertain this perceived need. It was found that a high percentage of qualified firefighters were interested in further academic offerings by HE institutions and that their aspirations are toward a structured Masters' degree. This type of Higher Education offering would furthermore, have to be presented through a blended learning method.

Keywords: Fire technology

1. INTRODUCTION

Rapid advances and changes in technology have also affected firefighting and its associated fields. It is assumed that a reasonably large number of firefighters have qualified for the National Diploma and are aspiring to enhance their academic qualifications so that, in conjunction with their advanced practical skills, they can improve their eligibility for promotion to leadership and or specialist positions. Apart from Tshwane University of Technology (TUT), currently providing higher education in Fire Technology up to Master's level, the Central University of Technology (CUT) is the only other institution providing higher education in Fire Technology (up to National Diploma level) in South Africa.

"Education and training are no longer optional activities, nor are they only for some members of the fire service. They are integral to safe and efficient operations and often determine to a large extent the effectiveness of individuals and departments." (Burke, 2006). Accordingly the US National Fire Academy presents training sessions in executive development, anti-arson techniques, disaster preparedness, hazardous materials control, and public fire safety and education. A number of colleges and universities in America also offer degrees in Fire Engineering or Fire Science (Firefighting Occupations, 2006). At present it seems that, whereas for all occupations in the USA nearly one-third (32%) of the employees possess a Bachelor's degree or more, in the protective services this figure is about 23.3% (CareerInfoNet, 2007).

Five SETA-accredited (Sector Education and Training Authority) training centres in South Africa certify the basic qualifications for a firefighter. This accreditation

is monitored and influenced by the South African Emergency Services Institute (SAESI), as no statutory board exists for fire and emergency services in this country. Further higher education, such as the National Diploma in Fire Technology, used to be offered by at least five Technikons, but with the changes in Higher Education and the rationalization of institutions this has dwindled to only two remaining institutions, TUT in Pretoria and CUT in Bloemfontein. The further and higher education presented by these two institutions is aimed at developing leadership and to a certain extent specialists in the field of firefighting.

In South Africa, however, training by the two relevant institutions is mainly focused on firefighting, thus apart from establishing whether there is a sustainable need in South Africa for an academically orientated, structured, higher education qualification such as a Master's degree in Fire Technology, there is also a need in South Africa to also establish the demand for diversification of the study field. The departure point of this study was a semi-structured questionnaire (utilizing quantitative questions, combined with some qualitative questions), augmented by a focus group interview to establish the status, needs, perceptions, preferences and attitudes of post-certificate firefighters and stakeholders. As a result of this methodology, the research was a form of systematic empirical inquiry (Shank, 2001), rather than being haphazard and subjective (Krathwohl, 1998).

2. RESEARCH TOOLS AND METHODOLOGY

2.1 Sampling

Utilizing an email database, provided by the South African Emergency Services Institute (SAESI), non-probability, purposive sampling was employed during the latter part of 2007, and included centres such as Bloemfontein, Kimberley, Welkom, Virginia, Cape Town, Port Elizabeth and East London. The target population included eligible firefighters (i.e. those in possession of either a National Diploma or a Bachelor Technologia (BTech) degree in Fire Technology). Members of management were included in order to establish their stance on this matter (Sommer, 2006) and to introduce multiple sources of needs assessment (Rouda & Kusy, 1995), thus significantly improving the reliability and the validity of the research, thereby enhancing the credibility of the outcomes..

2.2 Data collection

A survey employing a semi-structured questionnaire was the primary source of data for this study. A focus group discussion including knowledgeable persons from within the field of fire technology was employed in addition.

The questionnaire aimed to determine the academic history of potential learners, their perceptions of current practice amongst firefighting authorities, and their views on the scope of their careers, as well as their ideas on the appropriateness of a postgraduate qualification in this field. They were thus invited to offer

suggestions on content and feasible diversification; and they were also requested to make informed suggestions as to the mode of delivery of the envisaged programme. The response rate on the 92 questionnaires sent out was 77%.

A focus group with purposefully selected key role players, was convened to help corroborate the findings of this study, formulate the final conclusions and to make relevant suggestions and proposals as to the way forward for CUT.

3. DESIGN AND MODE OF INQUIRY

The research design for this study can be described as qualitative phenomenological, non-interactive and interactive, as well as a non-experimental quantitative survey (McMillan & Schumacher, 2001). Triangulation was used to designate a conscious combination of quantitative and qualitative methodology (De Vos, Strydom, Fouché & Delport, 2005) thereby trying to neutralize bias, which may be inherent in a particular data source, researcher or method (Creswell, 1994).

3.1 Sampling

In the survey prospective learners were identified by utilizing an official e-mail mailing list from the database of SAESI. The responsible staff members at the different fire stations were, furthermore, asked to identify additional prospective learners (non-members of SAESI) who could be included in the mailing list, thus adding a snowballing effect. For the focus group interview candidates were chosen for their proximity to the researcher as well as their standing in the Fire Service community, convenience thus being a major factor.

3.2 Survey design

Of the 50 questions used, about 42 were quantitative closed-ended questions, four were qualitative closed-ended questions and a further 4 were qualitative open-ended questions (Bowling, 2005).

3.3 Focus group interview

The focus group interview used a prominent group to share a controlled experience, such as the results of the questionnaire, and they were then required to respond to a related set of questions. This had the advantage that all participants shared the same stimulus material. Accordingly, 12 participants were invited to take part in a focus group interview for this study. The attendees represented a reasonable cross section of staff and management in the fire service and all had and still have very good contact with potential learners.

4. RESULTS

4.1 The questionnaire survey

4.1.1 Response rate

The response rate (77% of 92 questionnaires sent out) was quite high and may certainly indicate a real need. Unintentional selective response was considered as a factor in the response, but was discarded as 75% of the respondents are based in the Free State, Northern Free State, Northern Cape and in Eastern- and Western Cape, while 18% responded from Gauteng, another 4% from Kwazulu-Natal and 3% from Namibia.

4.1.2 Demographic data

4.1.2.1 Age and gender (Question (Q)15, 16)

Ages of respondents were recorded in three categories, young (18.3%), ranging from 20 to 30 years and including most firefighters just starting their careers; intermediate (66.2%), who were already established in their careers as firefighters and had possibly seen promotion, but were in all probability keen to advance their careers as much as possible; and older (15.5%), who had probably reached the apex of their careers and might (presumably) have been less interested in any academic means of furthering themselves (Figure 4.1). As expected and following traditional trends for the fire services in general, the gender division in the response was 91.5% males and only 8.5% females (Figure 4.1).

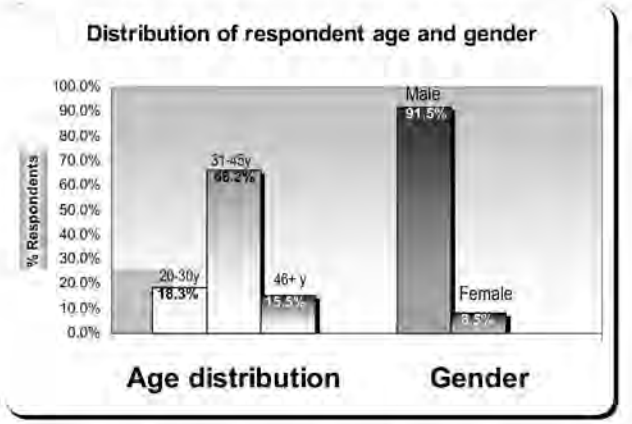

Figure 4.1 Distribution of respondent age and gender

4.1.2.2 Educational and professional attainment (Q17).

Almost all respondents were in possession of the professional qualifications of a firefighter, i.e. Firefighter I (97.2%), Firefighter II (97.2%) and Hazmat (98.6%).

Only 64.8% of respondents had the National Diploma in Fire Technology, and just over 1 in 10 (14.1%) possessed a BTech degree. Of the respondents, 1.4% were already in possession of a Master's degree (Figure 4.2). The small number of respondents not in possession of Firefighter I, Firefighter II and Hazmat qualifications (2-3%) can be accounted for by the few responses from incumbents outside the institutional fire services.

Figure 4.2 Dispersion of qualifications

4.1.2.3 Employment status (Q1-13)

Figure 4.3 shows the type of organization that employed the respondents: 23.6% employed by small and large municipalities without an accredited training facility; 45.5% employed by large(r) municipalities with accredited training facilities; 7.3% of employed by the South African Armed Forces. A further 25.5% of the respondents were categorized as "other", which included industrial companies, a coal mine, a stainless steel manufacturing company, a nuclear power plant and SASOL.

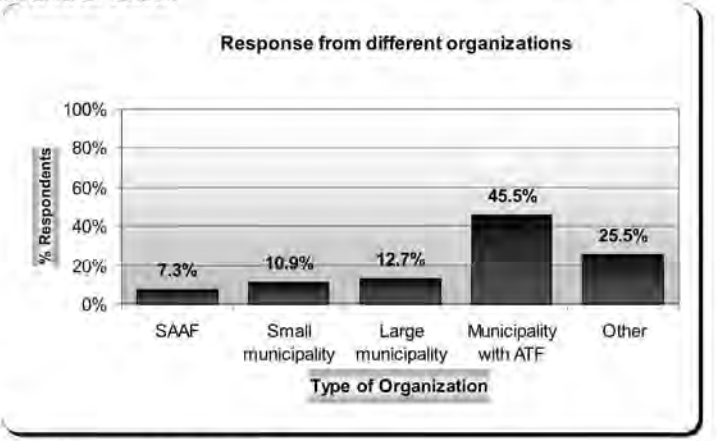

Figure 4.3 Workplace distribution

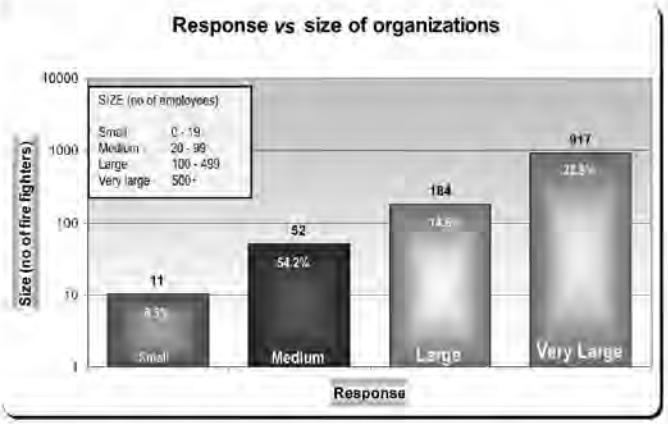

Figure 4.4 Response and size of organization

These organizations were also divided into size categories (Figure 4.4) according to the number of firefighters that they employed (Question 2). Thus 8.3% of the responses came from small organizations, 54.2% from medium organizations, 14.6% from large organizations, and 22.9% from very large organizations. Clearly these results reflect that the responses came from a reasonably diversified range of organizations.

The response per rank (Question 3) also showed a healthy measure of diversity (Figure 4.5). Dividing the rank spectrum into three groups, i.e. workers, comprising Firefighter, Senior Firefighter and Leader Firefighter; middle management, consisting of Station Officer, Assistant Division Officer and Division Officer; and top management comprising Assistant Fire Chief, Deputy Fire Chief and Fire Chief, yielded responses of 25.4%, 33.8% and 28.2% respectively. The 12.7% other mainly included ranks in the private sector such as Specialist, Senior Fire Engineering Technician, Executive Manager and District Manager. This reasonably uniform dispersion of responses through the ranks was bound to yield a more informed point of view overall concerning the need analyzed in this study.

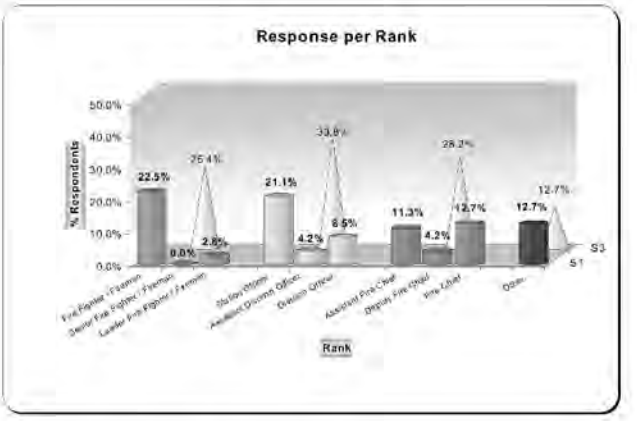

Figure 4.5 Response per rank

The interesting fact that the respondents' own perception of their managerial responsibility (Figure 4.6) seemed to differ from the real situation (Figure 4.5) can be accounted for by the 12.7% respondents from the private sector, many of whom actually held senior positions as indicated earlier.

Figure 4.6 Respondents' own perception of level of managerial responsibility

Table 4.1 Time in profession / organization / position

Profession	Period (in years) Responses % Response	<10 25 35.2%	10-24 34 47.9%	25+ 12 16.9%
Organization	Period (in years) Responses % Response	<10 37 52.1%	10-24 33 46.5%	25+ 1 1.4%
Position	Period (in years) Responses % Response	=<1 14 19.7%	>1<5 26 36.6%	>=5 31 43.7%

From Table 4.1 (Questions 4, 5 and 6) showed that the correlation between total time in the profession versus time spent with the same organization was high (r = 0.8675). The coefficient of determination is also quite high (r2 = 0.7526). Thus, it can be construed that there was only about a 24.7% movement by firefighters between organizations. This impacts on the availability of higher education facilities within an acceptable distance from the respondents' place of work and could explain the relatively large number of respondents who eventually listed a type of distance education as a requirement for their further studies. Figure 4.7 shows a multi variate graphical representation that indicates that, within organizations, firefighters are relatively soon promoted. Currently this promotion mainly mirrors movement toward managerial positions, reflecting negatively on diversification in the field of fire technology in South Africa.

Figure 4.7 Relationship: time in profession / organization / position

Table 4.2 Respondents in a position of supervision

Respondents doing supervision (46)	64.8%		
	Numbers of trainees		
Supervision over	Min. nr.	Max. nr.	Mean
Qualified firefighters	2	800	39
Trainee firefighters	3	50	16
Supervisors not stating number supervised (6)	8.7%		

According to the response to Question 9, a fair number (64.8%) of all respondents found themselves in a position of supervision, over qualified as well as trainee firefighters (Table 4.2). The fact that they supervised qualified employees could be a contributing factor in their sensitivity toward their own educational status. Figure 4.8 shows that only 46.6% of organizations made use of official mentors as advisors for newcomers and that at least a third of these mentors did not get some form of relief from their normal duties for this task, another factor that might also impact negatively on firefighters' attitude toward further higher education studies

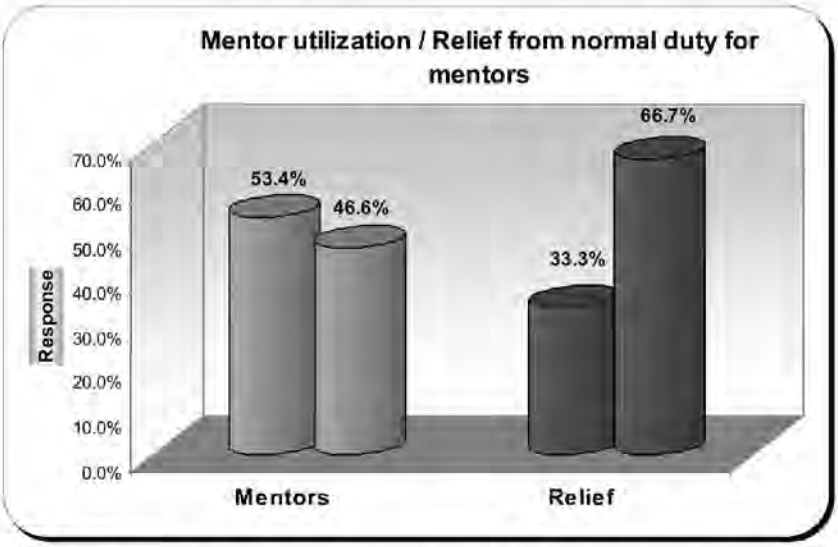

Figure 4.8 Mentor utilization and relief from duty for the mentoring task.

Table 4.3 Protocols for training of firefighters

Set protocols for:	% Yes	% No	% Split per organization size
Training	94.4	5.6	75.0 Small/Medium organization 25.0 Large/Very large organization
Extended training	72.9	27.1	73.3 Small/Medium organization 26.7 Large/Very large organization

From the results in Table 4.3 it is clear that most of the relevant institutions do have set protocols for training and a high percentage (72.9%) even have protocols for extended training. It can, however, only be hypothesized, and this was later confirmed during private discussions with members of the focus group, that the organizations without training protocols were perhaps the private institutions.

Question 12 requested respondents to give their perception of staff turnover (number of resignations per year) in their organizations. The results showed low turnover rate of 62.3% (Table 4.4), which tallies with results reported in Figure 4.1 showing a low movement of firefighters between organizations. It thus seems that firefighters have a rather low movement of members between organizations and furthermore also have a reasonably low perceived turnover rate, for reasons that are beyond the scope of this study.

Table 4.4 Response on staff turnover

Very low / low	62.3%
Medium	37.7%
High / Very high	0.0%

4.1.3 Educational and professional profile

4.1.3.1 Current studies (Q18, 19).

At the time of this study, nearly half (45.7%) of all respondents were in the process of acquiring a further academic qualification, which in itself is already an indication of the importance that eligible firefighters attach to further academic studies. On the other hand, more than half (54.3%) of respondents were not currently engaged in any academic studies (Figure 4.9). Many of these participants, however, indicated that given the right circumstances, they would be interested in acquiring higher academic qualifications.

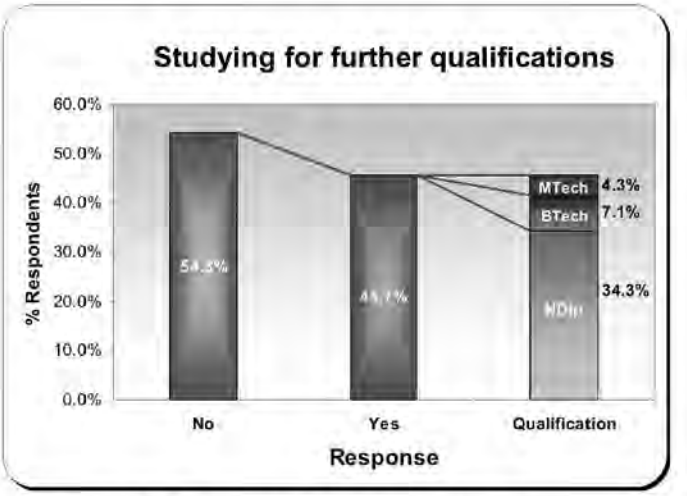

Figure 4.9 Studying for further academic qualifications

4.1.3.2 Membership of professional society (Q20, 21)

Belonging to a professional society can be a strong indicator of an incumbent's attitude toward his/her profession and his/her career. Professionalism amongst firefighters can thus be estimated by the fact that no less than 71.8% of the respondents belonged to a professional society. As their options were limited, 69% belonged to SAESI, with 16.9% having dual membership with another society. Only 2.8% of respondents belonged solely to a society other than SAESI (Figure 4.10).

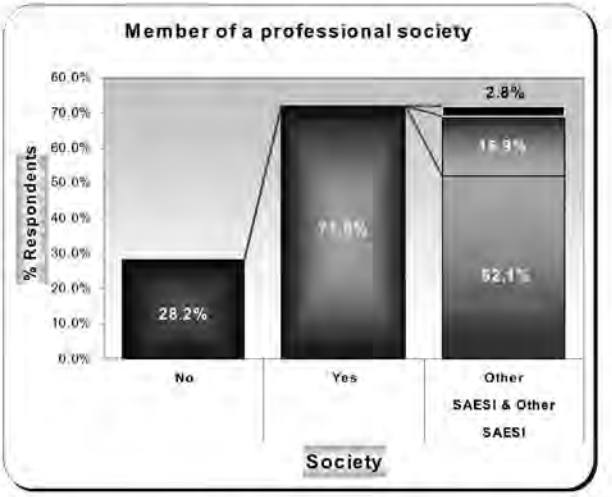

Figure 4.10 Professional society

4.1.3.3 Awareness and importance of academic education (Q22-24).

Attitude toward further academic education is certainly influenced by awareness thereof, and, as can be seen from Figure 4.11, more than 80% of the respondents were aware of the existence of higher education programmes prior to the survey. However, it is alarming that nearly 20% of all respondents indicated that they were not aware of any further academic education in their field. This could certainly indicate the need for a coordinated awareness programme, possibly run by SAESI, amongst firefighters eligible for possible career advancement.

Question 23 directly tested the respondents' attitude toward further academic education, as compared with professional training, by asking if they deemed this important. A total of 95.8% gave a positive response to the question (Figure 4.11). This response was confirmed and reinforced by the next question (Question 24) that polled them on whether extended academic education should thus be made compulsory for firefighters. The positive response of 67.6% is indicative of the significance that the respondents attached to extended academic education as a reinforcing factor in their educational status (Figure 4.11).

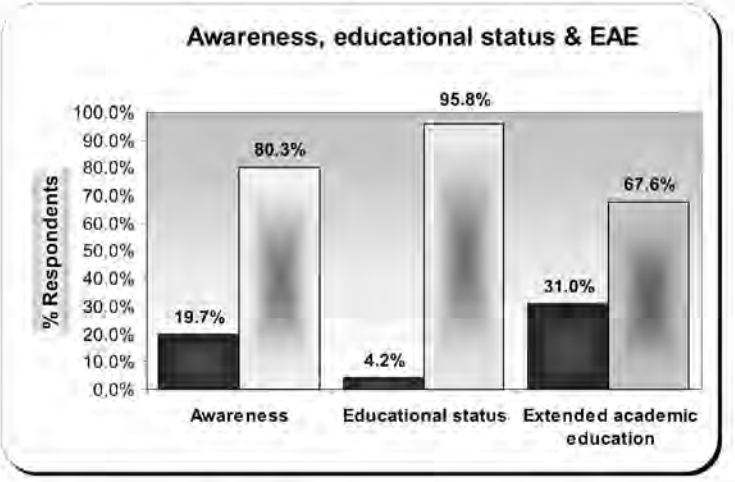

Figure 4.11 Awareness and status

4.1.3.4 Participation in further academic education (Q25-28).

Asked whether the participants would like to participate in further academic education (Question 25) a very substantial 91.5% of respondents reacted positively toward this (Figure 4.12). This question did not necessarily elicit a need, but rather reflects the attitude of firefighters in this category. With most of them either currently in the process of studying or having done some studying in the past, it can be assumed that they were reasonably familiar with the different delivery modes possible for such further academic studies.

It is thus informative that their response to question 25 shows a preference for some form of distance or combined mode (70.4%) over mere block groups (16.9%), where learners attend full-time face-to-face sessions of at least one week at a time, two to three times per semester (Figure 4.12). The respondents were, however, adamant that they did not simply want non-formal education, obtained by special courses, as only 4.7% chose this option. In contrast, 54.7% were in favour of formal education and the rest (40.6%) opted for both formal and non-formal education. It is thus obvious that more than 95% of the respondents would prefer further academic education of some kind (Figure 4.12).

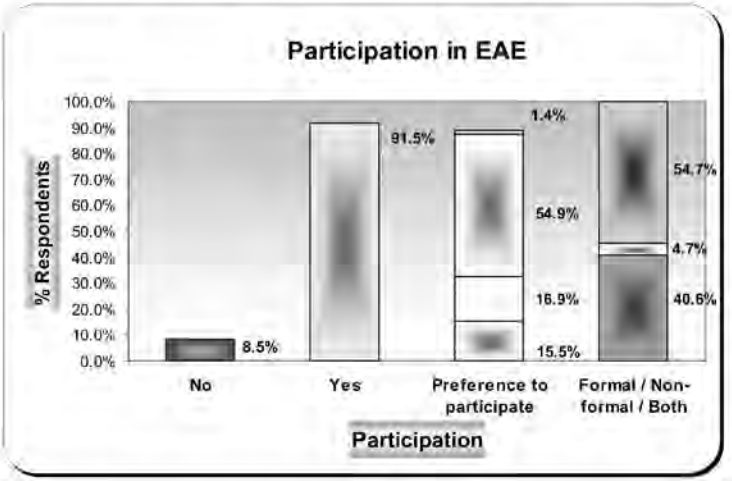

Figure 4.12 Participation in extended academic education

Asked about the informal activities attended during the last two years (Question 28) it transpired that short courses and workshops (i.e. the more hands-on activities) were the most popular (2.03 and 1.56 activities on average per respondent) with conferences and seminars lagging somewhat behind (0.98 and 0.63 activities on average per respondent) (Table 4.5). From this table, as well as from Figure 4.13, it can be seen that a high 96.6% of respondents attended short courses, with the attendance figure dwindling to just below 50% for seminars. Overall though, it would seem that firefighters are well catered for as far as informal education is concerned. If this attendance figure is related to size of the organization (Question 2) it becomes obvious that firefighters from small and medium organizations get the opportunity to attend the mentioned kinds of activities more frequently than do employees from the larger organizations (Figure 4.14).

From Table 4.6 it is evident that attendance of the various activities by employees of the different size organizations correlates highly ($r > 0.89$) and that there is a significant difference between attendance of employees from small/medium

versus large/very large organizations (t-test probability 0.314). This can, however, be accounted for by the fact that, in the larger organizations, there is much more specialization evident in work areas compared with the situation in smaller organizations. The consequence of this is that the employees of the smaller organizations may experience a kind of jack-of-all-trades effect and, because of this, they may have a tendency to attend more education and training activities.

Table 4.5 Activities attended during last two years (per person)

	Average number of activities	% Response
Short courses	2.03	96.6%
Workshops	1.56	86.4%
Conferences	0.98	52.5%
Seminars	0.63	49.2%
Other	0.03	3.4%

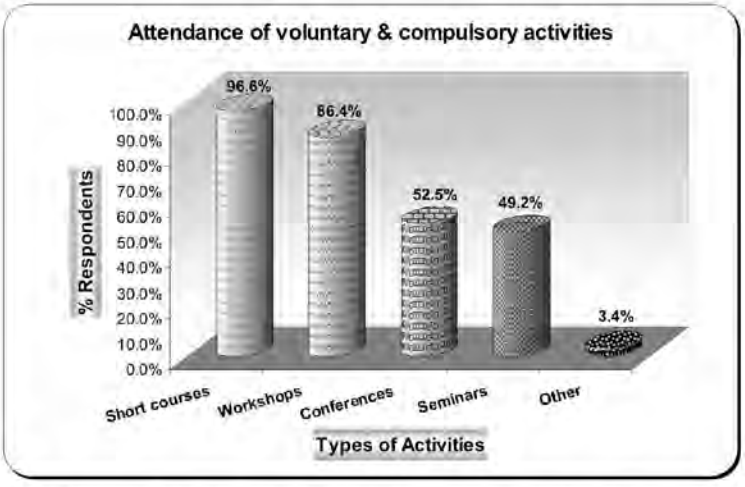

Figure 4.13 Attendance of voluntary and compulsory activities

Group	Size of organization	Total # Activities	AVG # Short courses	AVG # Work-shops	AVG # Confe-rences	AVG # Semi-nars
1	small	5.3	2.0	1.5	1.0	0.8
2	medium	5.8	2.0	1.9	1.4	0.5
3	large	3.2	1.6	0.8	0.4	0.4
4	very large	3.2	1.3	1.1	0.3	0.5
		Probability			r	r^2
1&4	t-test	0.362	Correlation		0.919	0.845
1&2	2 tails,	0.833	Product		0.944	0.891
1,2&3,4	2 sample equal variance	0.314	moment		0.899	0.809

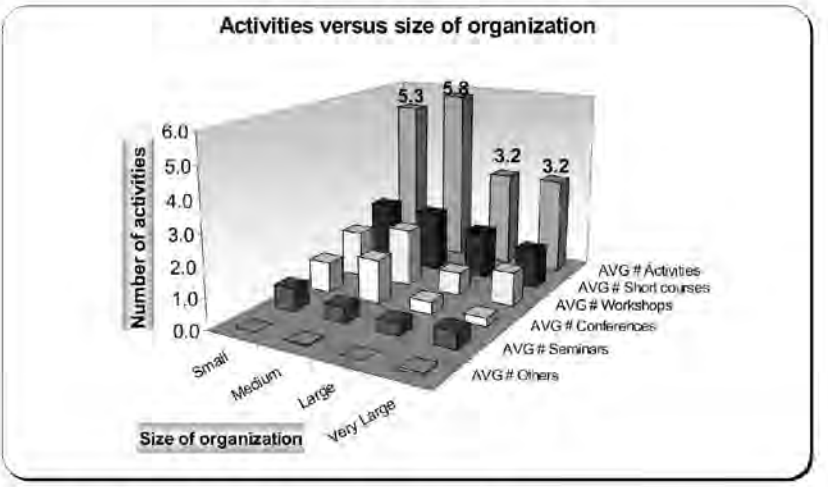

Figure 4.14 Activities versus size of organization

4.1.3.5 The fiscal factor (Q29-32).

Economy unfortunately plays a significant role in the major decisions employees have to make concerning their professions. The results show that the organizations mostly paid for run-of-the-mill education and training activities (Question 29) (67.6%, Figure 4.15), but unfortunately a significant 20.3% employees indicated that they had had to pay their own way. While there was some sponsorship (6.8%), this figure seems to leave much room for improvement and the fire services would be wise to explore this avenue further. What is however significant is the fact that according to the respondents there is a distinct and increasing trend in organizations to have employees initially pay for

their own studies (Question 30-31), and on successful completion of such studies, be reimbursed (compare the response of 24.2% for past studies with 30.3% for current studies.

This trend is satisfactory to both the employer in that no financial help will be offered if a candidate is unsuccessful and to the employee in that the organization bears the financial burden if the employee is successful in his/her studies. The added benefit of this arrangement, of course, lies in the motivational aspect. The response to Question 32 indicated that, on average, a total of R 8578 had been spent on the studies of each employee during the previous year (2005). This figure shows how expensive higher education studies have become, but the impact is softened by the fact that many learners do not enrol for all subjects. The cost factor admittedly is a dynamic factor that keeps on rising.

4.1.3.6 In-service training (Q33-35)

As can be seen from the results in Figure 4.15, in-service training is reasonably well catered for by the employers (67.6%) and has been adequately attended over recent years. It could be argued, however, that in-service training is the mainstay of an active fire service and should thus play a major role. If this was an accepted fact, the response to this question should have been much more positive. The mode of presentation is mainly through block weeks (58%) as this best suits the operational needs of the firefighter candidates.

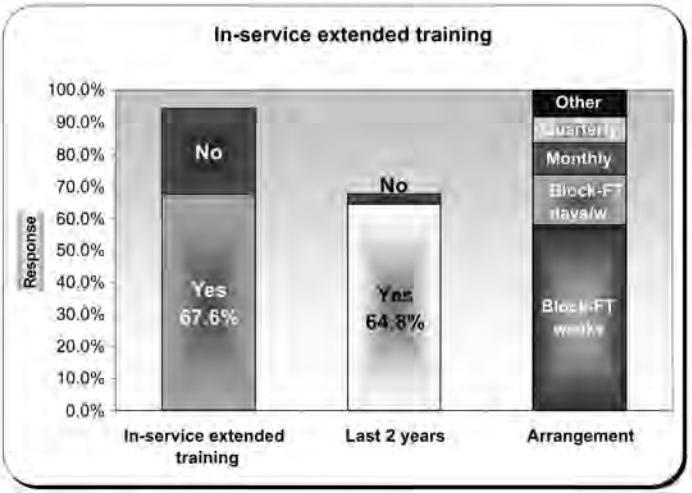

Figure 4.15 In-service extended training

4.1.4 Possible constraints to studying

4.1.4.1 Learning needs (Q37,38).

These two questions used the terms academic learning needs and professional learning needs respectively, without offering any definition to distinguish between them. Academic learning needs imply those factors that may lead to the acquiring of academic qualifications (mostly through academic institutions). Contrary to this, professional learning needs imply those factors that lead to strictly applied (practical) professional qualifications. From Figure 4.16 it can be seen that organizations either do provide equally for both of these learning needs (57.7%), as it should according to the SETA aims, or in the respondents' minds they view the two types of learning needs as being the same. The response rate for this question showed just over 10% not responding, which can also indicate a measure of confusion or ignorance on the part of respondents in respect of this topic.

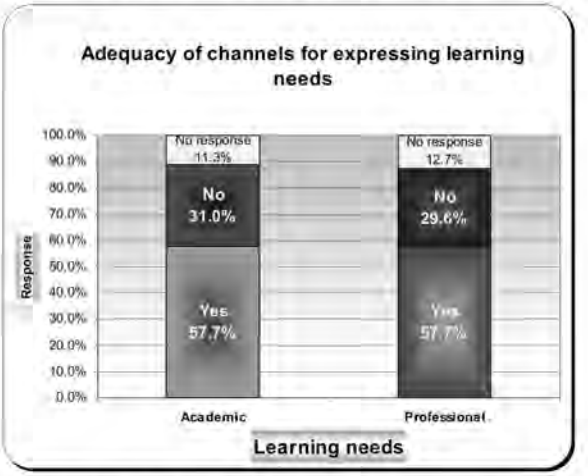

Figure 4.16 Adequacy of channels for expressing learning needs

4.1.4.2 Specialization (Q39,40).

If taken together the results of questions 39 (on professional learning needs) and 40 (on rotation) may indicate a significant measure of specialization in the relevant organizations, as lower levels of rotation (59.2%, Figure 4.17) usually imply higher levels of specialization. This may impact significantly on the curriculation of a postgraduate degree such as envisaged in this study. Furthermore, many of the incumbents indicated that rotation only works in selected areas (7.0% of all respondents and 23.7% of the ones indicating rotation (Figure 4.17)). However, contrary to what one would expect the respondents from small/medium organizations indicated less rotation in their work (thus more specialization) (58.6%, Table 4.7) than the employees of large/very large organizations.

Table 4.7 No rotation (specialization) versus organization size

Organization size	% No
Small	6.9
Medium	51.7
Large	13.8
Very large	27.6

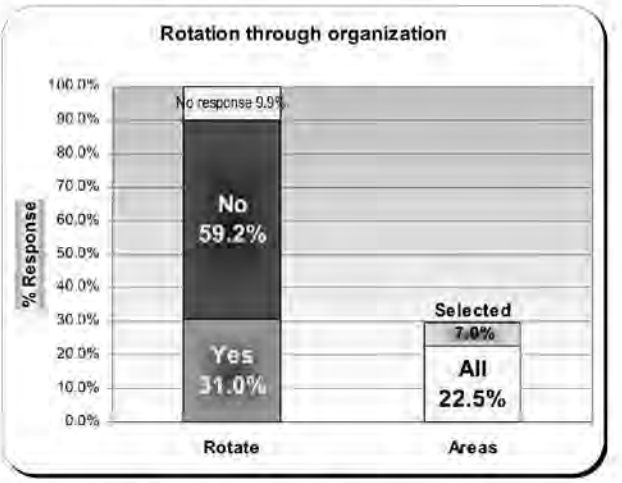

Figure 4.17 Rotation through organization

4.1.4.3 Listed constraints to further academic studies (Q 41).

Nineteen potential constraints to further academic studies were listed in this question and respondents were asked to rank them in four categories from no constraint to major constraint. The results of Question 28 were also used to divide the responses into two categories: those who attended three or fewer academic activities in the previous two years, and those who attended more than three academic activities in the same period. In general the results given in Table 4.8 show a lack of reward or incentives to be the major constraint listed by the majority of respondents. This was followed closely by organizational factors such as staff shortages and lack of staff back-up. Thus, looking at the three most significant constraint vectors it was obvious that they were organization dependent and operational related. Payment of fees/expenses also feature relatively high on the constraint list and is also something that the employer could address through arrangements beneficial to both employer and employee. The fact that the employers allegedly also did not seem sufficiently interested in the extended academic education of their employees may indicate a lack of vision and education on their part or even a problem of not taking cognisance of recent

international trends. This can only be remedied by education of the managements of these organizations as to such trends and the driving force behind them.

A worrying fact is that respondents seem to lack awareness of the academic programmes provided in this country (constraint ranked 5th). Although this may be mainly a fault of the service providers, it could also to a lesser degree be the fault of the employer. Through a joint awareness programme this constraint could, however, easily be overcome.

Correlating the two categories mentioned, $r = 0.748$ indicating that there is no significant difference in the responses of these two groups (at $P = 0.05$ as well as $P = 0.01$). Interestingly, however, the low- and no-attendance category differ in their top 10 constraints by including after-hours duties, lack of time after-hours (other than after hours duties), and lack of distance education facilities such the Internet. Contrary to this, the high attendance group includes lack of motivation no need; lack of transport; and professional workload too high. If this result is interpreted in the light of what was found in 4.1.3.4, it seems that employees from small/medium large organizations suffer from lack of motivation and a professional workload that tends to be high. Both these factors can be related to the size of the organization and this thus tallies with what could be expected. It would, however, be risky to venture reasons, without further investigation, for the fact that employees from large organizations tend to have a problem with after-hours duties as well as lack of after-hours time. Furthermore, one would expect larger organizations to have better facilities (like Internet) available for their employees.

If the trend lines for the constraint vectors are studied (Figures 4.18a-c) it is clear that there is less variation in the constraint spectrum as perceived by the low- and no-attendance group compared with the high attendance group. The high attendance group, however, shows less variation within a constraint category than the other group (Figures 4.18b,c). Thus, in this study, employees from smaller organizations tended to be more consistent in their perceptions of constraints.

Table 4.8 Listed constraints

Constraint	Relative position		
		Attendance of activities*	
A	All	<=3	>3
Lack of reward or incentives	**1**	1	2
Staff shortages	**2**	2	1
Lack of staff backup	**3**	4	6
Payment of fees/expenses	**4**	3	7
Not always aware of programmes provided	**5**	5	3
Lack of motivation - no need	**6**	12	4
Professional workload too high	**7**	11	10
No time release from work for classes	**8**	8	9
Lack of transport	**9**	13	8
Employer not interested in extended academic education	**10**	7	5
Lack of distance education facilities such as the internet	**11**	9	15
Lack of time after hours, other than after-hour duties	**12**	6	14
After-hourduties	**13**	10	13
Difficult to obtain leave	**14**	15	16
No longer accunstomed to studying anymore	**15**	14	17
Time of educational activities not suitable	**16**	16	16
Duration of contact sessions too long	**17**	17	11
Other (please specify):	**18**	19	12
Lack of confidence in the organization providing training	**19**	20	20
Language used as medium of communication for activities	**20**	18	18

B Low- and non-attendance (<=3)			
Lack of reward or incentives	1	**1**	2
Staff shortages	2	**2**	1
Payment of fees/expenses	4	**3**	7
Lack of staff backup	3	**4**	6
Not always aware of programmes provided	5	**5**	3
Lack of time after hours, other than after hour duties	12	**6**	14
Employer not interested in extended academic education	10	**7**	5
No time release from work for classes	8	**8**	9
Lack of distance education facilities such as the internet	11	**9**	15
After-hour duties	13	**10**	13
Professional workload too high	7	**11**	10
Lack of motivation - no need	6	**12**	4
Lack of transport	9	**13**	8
No longer accustomed to studying anymore	15	**14**	17
Difficult to obtain leave	14	**15**	16
Time of educational activities not suitable	16	**16**	16
Duration of contact sessions too long	17	**17**	11
Language used as medium of communication for activities	20	**18**	18
Other (please specify):	18	**19**	12
Lack of confidence in the organization providing training	19	**20**	20

C High attendance (>3)			
Staff shortages	2	2	1
Lack of reward or incentives	1	1	2
Not always aware of programmes provided	5	5	3
Lack of motivation - no need	6	12	4
Employer not interested in extended academic education	10	7	5
Lack of staff backup	3	4	6
Payment of fees/expenses	4	3	7
Lack of transport	9	13	8
No time release from work for classes	8	8	9
Professional workload too high	7	11	10
Duration of contact sessions too long	17	17	11
Other (please specify):	18	19	12
After-hour duties	13	10	13
Lack of time after hours, other than after hour duties	12	6	14
Lack of distance education facilities such as the internet	11	9	15
Difficult to obtain leave	14	15	16
Time of educational activities not suitable	16	16	16
No longer accustomed to studying anymore	15	14	17
Language used as medium of communication for activities	20	18	18
Lack of confidence in the organization providing training	19	20	20

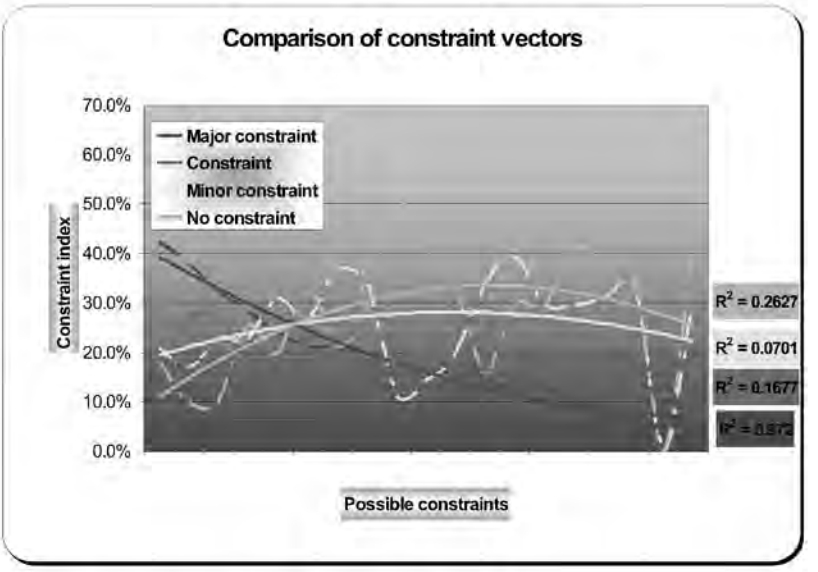

Figure 4.18a Comparison of constraint vectors

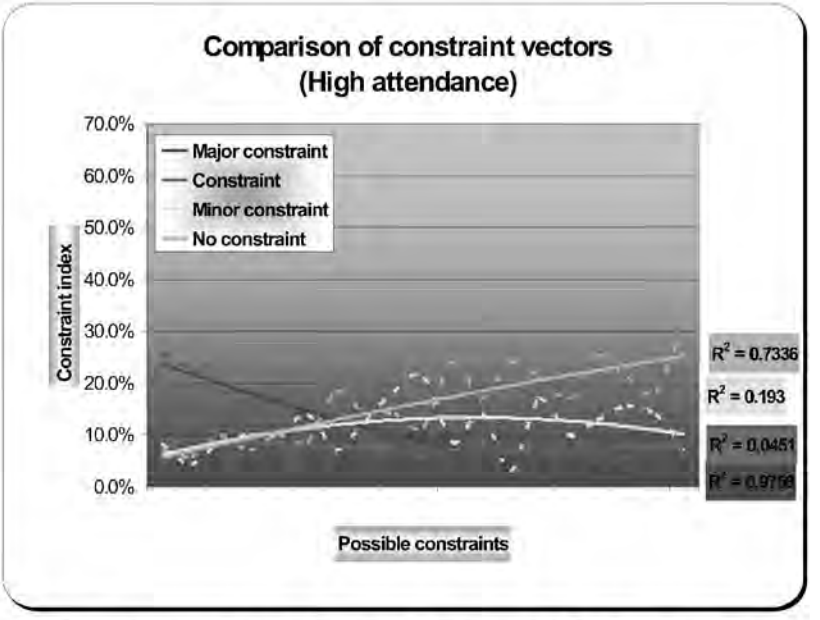

Figure 4.18b Comparison of constraint vectors (High attendance)

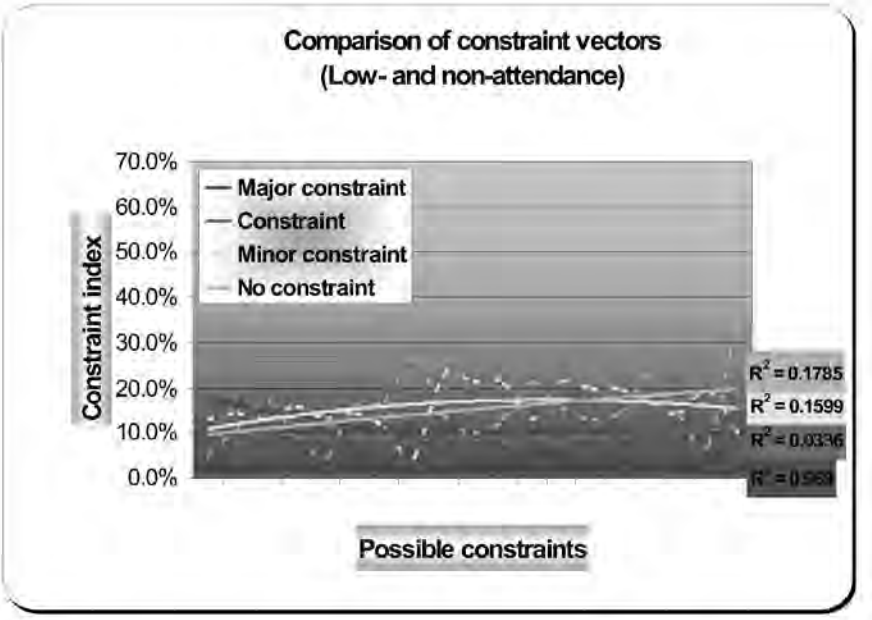

Figure 4.18c Comparison of constraint vectors (Low- and non-attendance)

4.1.4.4 Access to Internet (Q 42,45).

Roughly a third of all employees indicated that they had their own access to the internet and were thus able to facilitate their own distance education (Table 4.9). Only 16% of all respondents did not have any access whatever to the internet (Figure 4.19), but a promising 76% indicated that they would consider buying/upgrading their own computer facility so as to be able to assist their own distance education (Table 4.9). Some 56% of the study respondents thus had access to at least a single computer/internet facility, whereas 28% had multiple access that should ensure a complication-free gate to distance education (Figure 4.19).

Table 4.9 Access to internet

Access type	%
Own	30%
Employer	50%
Other centre	29%
Would consider spending on facility	76%

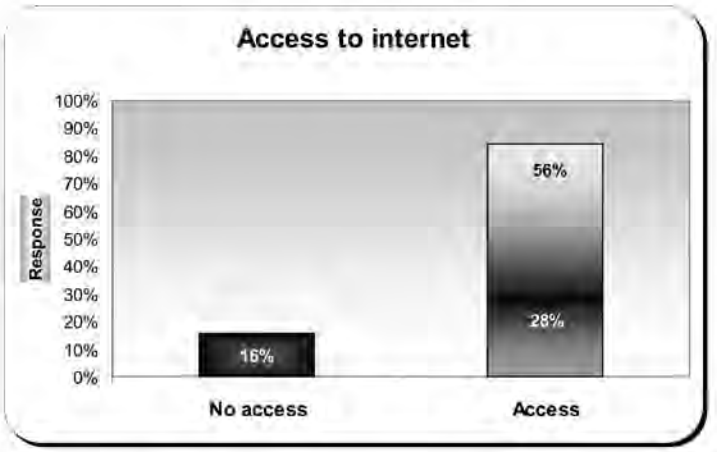

Figure 4.19 Access to internet

4.1.5 Extended educational needs

Asked about their propensity toward studying a Master's degree, respondents revealed an overwhelming enthusiasm (97%) to participate in this kind of study (Figure 4.20). Although this figure may seem rather overly enthusiastic, it is still a very positive indication of the attitude of these firefighters in general. Of the positive response, 63% indicated a preference for some form of structured degree study with a research study constituting only half of the required credits and with the other half being made up of modules culminating in summative assessments (Figure 4.20).

A very high proportion (89%, i.e. 56/63 (Figure 4.20)) of the respondents who indicated a preference for a structured format for such a degree, also preferred to do occasional single modules that could lead to accreditation and recognition towards a Master's degree at a later stage. Any arrangement like this will, however, have to be monitored very well so as not to drag the study out over too long a period. This indicated preference may most probably be ascribed to work and or financial pressure, as indicated in 4.1.4.3.

Asked to state their most pressing academic needs (Question 46, 47), it was no great revelation that 32% of the respondents favoured acquiring a B-degree and 12% already indicated the wish to obtain a Master's degree (Table 4.10). On the professional side, 15% of the respondents indicated an aspiration to ascend the ranks of their organization. Another 13% aspired to attain the competencies enabling them to maintain a good Fire Service and render the best possible service to the community (Table 4.10). It is thus obvious that if the respondents' main professional needs centre on promotion and service, that their academic needs would be directed toward higher qualifications, but moderated by functionality.

The academic and professional needs of the respondents are substantiated by what they think about the significance of specifically a Master's degree (Questions 49 and 50). A significant 70% of the respondents were positive that such an additional higher education qualification would improve the chances of advancing their careers (Figure 4.21). In turn, 72% of the respondents were of the opinion that the significance of obtaining a Master's degree would be important / critically important to their careers in general (Figure 4.21).

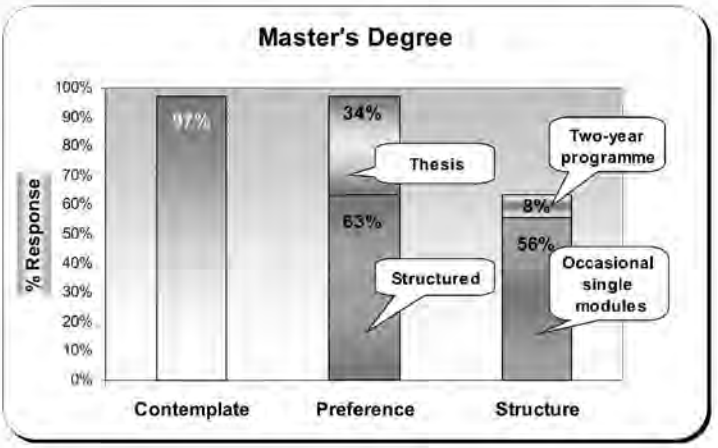

Figure 4.20 Preference of postgraduate degree

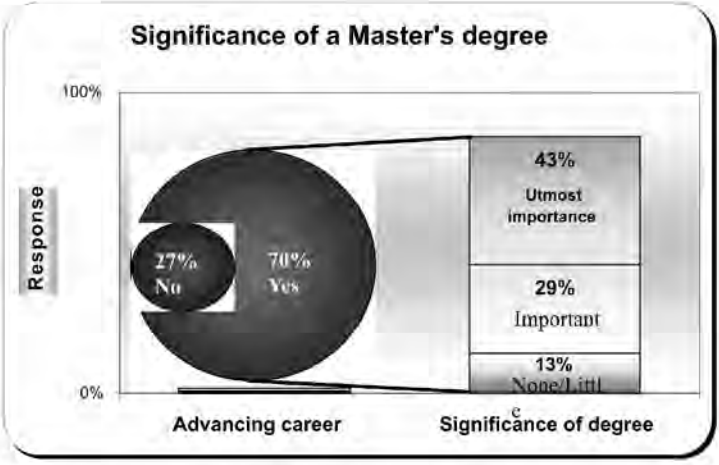

Figure 4.21 Significance of a Master's degree

Table 4.10 Most important academic and professional needs (% given for needs with 5%+ response)

Most important academic needs	% Response	Most important professional needs	% Response
B-degree covering all fire relevant subjects (Risk Management, Fire Service Operations, Fire Service Management, Fire Service Training, Fire Management, Process Safety Management)	18	To ascend the ladder of our organisation	15
B Tech (presumably as is)	14	Make contribution to a well maintained fire service	8
Master's degree (M Tech, Buss. Management)	12	Be as competent as I possibly can be to maximize my output to the community	5
Access to information regarding further studies and/or courses offered	6	Be able to share my knowledge with the younger colleagues in our organisation	5
Obtain Doctorate		Train competent firefighters / medics	
Info on Fire Risk Assessment / Computerised Risk Assessment		Training in Urban Search and Rescue	
Understanding the topic, not just learning "parrot fashion"; relating topics/linking		Recognition as professionals by other professionals	
Interaction that is fruitful between the researcher and study leader/Advisor		To keep abreast of with changing technology	
Distance learning		To have the opportunity to be promoted on competence rather that demographics/ equity	
Obtain degree in Mechanical Engineering		The implementation of a single firefighting methodology and training that supports saidmethodology	
Diploma in Business Continuity		The availability of recourses for the development of all staff levels	
MBA		Structured course layout that leads to a conclusion. At least relevant references to inter-relations between topics.	
Obtaining adequate relevant knowledge pertaining to my field		Project planning	
Labour relations and Motivation		Project management	
ISO auditing course		Operations	

To complete major hazard installations requirements for certification		Knowledge of municipal financial acts	
Info on Professional Fire Investigating		More seminars in Namibia for Examinations	
Obtaining the approval to study further		More recognition	
No research - More short courses		Managing staff	
Referencing system, internet sites, other avenues of research		Knowledge of adaptational variations for operational needs	
Employer willingness to attend and fund studies		IT skills	
Recognition of achievements, via either promotion or remuneration		Hazardous materials	
Transformation		Financial planning	
Assistance in the development of the research proposal and design		Establish a test and research facility for developing new f/f equipment	
Supervisors who actually keep the chosen study on track		Change management/cultural diversity	
		Be able to communicate on par with other professionals	
		Actual physical representation of theoretical aspects where possible, be it through video or slide show	

5. SUMMARY OF FINDINGS

5.1 The need for a higher education qualification (such as a Master's degree) in the broader field of firefighting

The literature study makes it evident that, regarding fire services, the present situation in South Africa is not at all progressive. The industry has no statutory board regulating it, thus the different fire services tend to see themselves as autonomous, with the consequent disarray. Furthermore, political appointments in local governments play a major role in destabilizing the industry. Some of the results of this destabilization are that fire services have too few employees even though theoretically, the posts do exist. This necessitates four shifts instead of the usual three, thus preventing employees from attending events of an educational nature. It further impacts on the age distribution of employees and ultimately on their attitude toward further academic studies, as young people is more inclined to study further.

Nevertheless, the results of this study have shown a high predisposition towards further academic studies amongst the target population. This predisposition is

so pronounced that roughly two-thirds of the respondents deemed it necessary to make higher-education qualifications compulsory for this group. As a very high 95% of the respondents indicated that they would like extended academic education to be formal, it can be concluded that this should take place through formal programmes presented by institutions of higher education.

5.1.2 The need for diversification into specialist fields

Since there is currently very little, if any, real education in specialist fields (like fire investigation, etc.), the presentation thereof through formal higher education programmes can only benefit the industry in general, but especially employees of small organizations. These employees could then be afforded a much greater opportunity of advancement and of progression in the industry as a whole.

5.1.3 The structure of the programme

Concerning the structure of such a proposed programme of higher education, the majority of respondents chose a structured programme above a single dissertation. They, furthermore, would prefer a system where they could study single modules at a time, which would eventually accrue toward a Master's qualification.

5.1.4 The mode of delivery

The geographical locality of many of the potential learners necessitates some form of blended learning. Since most of them (84%) have some form of access to multimedia like the internet, and 75% of the respondents further indicated their willingness to make the financial outlay to acquire internet access, it is not surprising that more than half of them prefered distance education. It can thus be concluded that a form of blended learning which will include distance learning, and probably also block groups, will have to be utilized in such a proposed programme in contrast to the current situation for learners in the National Diploma programmes.

Awareness of the opportunities for higher education needs to be improved and the institutions presenting or planning to offer higher education programmes would have to make a significant contribution in this regard, together with SAESI and local authorities.

5.2 Recommendations

This study shows that there is a real and sustainable need in South Africa in central and southern regions especially - for an academically orientated, structured, higher education qualification such as a Master's degree in Fire Technology. Thus answering the study's research question.

Reflecting on this research question and the subsequent subsidiary questions, the following recommendations are proposed:

5.2.1 The need for a higher education qualification (such as a Master's degree) in the broader field of fire-fighting.

There is scope for CUT to institute a Master's Degree in Fire Technology as a definitive need for such a qualification has been established. This need is based on the keenness of participants to continue with further higher education (Figure 4.12).

- Taking a comprehensive view of the education situation of fire services in South Africa, it is recommended that an advanced higher education programme, such as a Master's degree be instituted by CUT to cater for the HE needs of learners, particularly from the central and southern parts of South Africa.

5.2.2 The need for diversification into specialist fields.

Internationally the trend is for fire services to diversify in their training. Very little real education in specialist fields of fire services is currently presented in South Africa by the two relevant institutions (who mainly focus on firefighting and management). The diversification through formal higher education programmes would therefore benefit the industry as a whole.

- It is thus recommended that specializetion be implemented role in any newly curriculated Master's or any post graduate programme of higher education such as envisaged.

5.2.3 The structure of the programme

As existing HE programmes in South Africa up to BTech level are delivered in the form of semester block modules, and the Master's degree presented by TUT is presented as a part-time unstructured programme, the options of unstructured versus structured Master's degrees was assessed and verified and it is recommended that

- The structure of the proposed degree should consist of a dissertation and both compulsory and elective modules, where especially the elective modules can contribute to diversification into specialist fields.

5.2.4 The mode of service delivery

The undergraduate mode of delivery at the CUT and TUT comprised part-time learning consisting of formal contact sessions. The preferences, abilities and amenities of potential learners were assessed and analysed

- The mode of service delivery should be a form of blended learning consisting of block group attendance of formal classes (perhaps one week per semester), supported by distance-education media such as the internet.

As a high percentage of respondents indicated a lack of awareness of existing extended academic education in their field, an additional recommendation is made:

- An awareness programme, promoting existing higher education programmes offered currently in South Africa should be undertaken by the institutions of higher education in conjunction with SAESI and the local authorities.

6. REFERENCES

Bowling, A. 2005. *Techniques of questionnaire design.* In: Bowling, A. and Ebrahim, S., (eds). Handbook of health research methods: investigation, measurement and analysis. Open University Press, Maidenhead, UK.

Burke, P.R. 2006. A message from the Principal of the Ontario Fire College. <http://www.ofm.gov.on.ca/ENGLISH/Education/Firecollege/calendar06.asp#A_MESSAGE_FROM_THE_PRINCIPAL_OF_THE_ONTARIO_FIRE_COLLEGE_> Retrieved 12 October 2006.

CareerInfoNet. 2007. Distribution of educational attainment. http://www.acinet.org/acinet/occ_rep.asp?id=1&next=occ_rep&level=&optstatus=000001000&nodeid=2&soccode=331021&stfips=51&jobfam=17 Retrieved 07 April 2007.

Creswell, J.W. 1994. Research design: qualitative and quantitative approaches. Thousand Oaks: Sage.

De Vos, A.S., Strydom, H., Fouché, C.B. & Delport, C.S.L. 2005. Research at grass roots: for the social sciences and human service professions. 3rd ed. Pretoria: Van Schaik.

Fire Fighting Occupations. 2006. Training, other qualifications and advancement. http://www.readingpafire.com/carreer_in_firefighting.html Retrieved 30 March 2006.

Krathwohl, D. R. 1998. Methods of educational and social science research: an integrated approach. (2nd ed.). New York: Addison-Wesley Educational Publisher, Inc.

McMillan, J.H. & Schumacher, S. 2001. *Research in education: a conceptual introduction*. New York: Longman. 31-36.

Rouda, R.H. & Kusy, M.E. 1995. Needs assessment - the first step. *Tappi Journal* 78 (6): 253-257.

Shank, G. 2001. It's logic in practice, my Dear Watson: an imaginary memoir from beyond the grave. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* [On-line Journal], 2(1).

<http://www.qualitative-research.net/fqs-texte/1-01/1-01shank-e.htm> Retrieved 13 November 2006.

Sommer, B.A. 2006. Psychology at UC Davis. Types of samples.

<http://psychology.ucdavis.edu/sommerb/sommerdemo/sampling/types.htm> Retrieved 04 June 2007.