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Civil engineering technikon students' perception of the experiential learning programme

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This paper reports on a study of civil engineering students' perception of selected aspects of the experiential learning programme, which is a required component of the National Diploma programme. The findings indicate that the students usually found the work assignments given to them manageable and usually to be relevant to their professional growth. While they usually found there was a link between the courses covered at the technikon and the tasks performed, the former only moderately prepared them for the experiential learning. They rated the overall experiential learning programme as good.

INTRODUCTION

The engineering profession, like many other professions, requires that aspiring professionals complement their theoretical training with periods of experiential learning in the world of work before obtaining their academic qualifications.

Since the programmes offered at technikons are vocationally applicable, experiential learning is incorporated in the overall training of the undergraduate. The students are exposed to the world of work under the supervision of a qualified mentor for at least one year. This component of the undergraduate programme at the technikons is an essential feature of the training and it is grounded in the principles of co-operative education and the theory of experiential learning. *Co-operative education* may be defined as a system that integrates a student's academic studies with work experiences (Horn 1991) while *experiential learning* itself can be defined as an activity which facilitates the development of experiential knowledge (Burnard 1988). Technikon education therefore emphasises the integrated learning between practice and theory which is supposed to be achieved during the experiential learning period. It is hoped that, at the end of the experiential learning period, the student would have gained both technical and non-technical experiences to add on to the engineering knowledge acquired in the classroom setting and that as such the programme offers a quality learning experience to the student. In order to evaluate this component of learning, one equally needs feedback, as is the case with classroom learning. In this way, one will be in a better position to know whether the technikon's client, the student, is satisfied with the overall education and training.

The author is of the opinion that an investigation into the students' perception of their experiential learning should provide valuable information for the process of quality assurance of academic programmes, which is important for both the academic institution and industry. Results of the analysis of such information should guide the further development of the experiential learning

programme wherever necessary and reinforce areas where the students have indicated a positive rating.

The objective of this study was therefore to measure the actual student perception of the experiential learning programme by exploring civil engineering students' views towards experiential learning at different technikons. The emphasis in the present study concerns the students' perception towards preparedness for the experiential learning, supervision, how manageable the given work assignments were during the training, and finally their perception about the overall experiential learning programme. The paper does not deal with the extent to which outcomes in terms of the development of professional skills, knowledge and attitudes are developed during the experiential learning, nor does it make a comparative analysis of the ways in which experiential training is managed at the different technikons that participated in the study.

RESEARCH METHODOLOGY

A small-scale survey was first conducted in 1997 with 16 civil engineering students who had just completed their experiential training at Port Elizabeth Technikon, to investigate their perception about their training. The exercise was part of an ongoing evaluation of the civil engineering programme at the Port Elizabeth Technikon. The author found the results worth sharing and it was decided that the survey be extended to include a larger sample of participating civil engineering students from other technikons. Early in 1999, five other technikons, randomly chosen, were invited to participate in the study. Four technikons responded positively and were either sent a requested number of questionnaires or e-mailed/faxed a copy of the questionnaire to be administered by the supervisors of experiential learning in the Departments of Civil Engineering at the respective technikons. This study is based on the completed questionnaires obtained from four technikons, namely Technikon Witwatersrand, Vaal Triangle Technikon, Peninsula Technikon and Port Elizabeth Technikon.

The enquiry was conducted by means of a 22-item questionnaire which addressed selected issues of experiential learning. The first 14 items, considered to be indicators contributing to quality experiential learning, required the students to indicate their rating to a particular item on a five-point scale, A to E, with A being the highest rating and E the lowest. Items 15 and 16 on the questionnaire required a yes or no answer. Here students were asked to indicate respectively whether they had had any work experience before going on the formal experiential learning programme, and whether they would go back to the same organisation if they had to do experiential training again. Items 17 and 18 required ticking in appropriate boxes and dealt with non-technical skills that the student felt they had acquired during the training and the type of employer the student was placed with. Items 19 to 22 required the students to give their level of academic standing when they went for experiential learning and make statements about positive and particular aspects they valued most during their experiential training, and problems of the training programme in general.

The questionnaire was administered to students who had just returned from their experiential learning period and had been with industry for at least six months. No distinction on the basis of gender was made in the analysis. There were 48 participants from Technikon Witwatersrand, 36 from Port Elizabeth Technikon, 26 from Peninsula Technikon and 15 from Vaal Triangle Technikon, making a total sample of 125 participants.

Out of the 125 participants, 106 (85%) went on experiential learning after the second semester, 10 (8%) after the first semester, and 8 (6%) after the third semester. A preliminary inspection of the responses of the group that went on experiential learning after the first semester revealed that their mean rating about their satisfaction with the experiential learning was close to the overall mean ranking of the whole sample. Hence the results are presented without any distinction with respect to the level of academic standing.

ANALYSIS AND DISCUSSION OF RESULTS

First to be discussed are the first 14 items, considered to be indicators contributing to quality experiential learning, which were used to determine the students' perception of their training. These items fall within the two of the five variables that, according to Apostolides and Looye (1997), constitute elements of the overall rating of the co-op experience, namely *Supervision* and *Co-op work assignment*. The fourteen items being considered were as given in table 1 below.

Table 1 Selected items on experiential learning

1	Extent to which new knowledge was acquired through contact with immediate supervisor
2	Extent to which knowledge was acquired through contact with workmates
3	Rating of personal contribution to the performance of the section or organisation the student worked for
4	Extent to which the experiential training satisfied the student's expectation
5	Extent to which the courses covered at the technikon prepared the student for experiential training
6	How often tasks given were relevant to the student's professional growth
7	Overall rating of the experiential programme
8	How often the student liked the work he/she did
9	How often the immediate supervisor briefed the student before giving the task
10	How often the student understood the tasks to be done
11	How often the work performed stimulated creative thinking
12	How often the task given offered an opportunity for independent thinking
13	How often was there a clear link between the theory covered at the Technikon and the tasks performed
14	How often the tasks were manageable
Depending on the item being judged, the responses on the scale of A to E were as follows:	
A Very much/Very high/Very satisfied/Excellent/Always	
B Much/High/Satisfied/Very good/Usually	
C Moderate/Generally Satisfied/Good/Seldom	
D Little/Low/Dissatisfied/Never/poor	
E Very little/Very Low/Very Dissatisfied	

Table 2 Overall rating of selected items on experiential learning

Item	Rating of item per institution				Mean score	Standard deviation	Ranking
	Technikon A	Technikon B	Technikon C	Technikon D			
14	4,346 (0,693)	4,297 (0,523)	4,330 (0,517)	3,604 (1,026)	4,336	0,625	1 (94)
10	4,115 (0,548)	4,417 (0,554)	4,400 (0,507)	4,267 (0,652)	4,325	0,583	2 (92)
9	4,308 (0,678)	4,405 (0,288)	4,533 (0,640)	4,064 (0,787)	4,266	0,707	3 (87)
6	4,269 (0,726)	4,140 (0,674)	4,667 (0,614)	4,104 (0,807)	4,224	0,735	4 (83)
8	4,230 (0,592)	4,054 (0,537)	4,533 (0,640)	4,043 (0,777)	4,169	0,675	5 (87)
12	4,231 (0,648)	4,108 (0,659)	4,330 (0,517)	4,042 (0,738)	4,161	0,424	6 (86)
11	4,269 (0,539)	3,080 (0,601)	4,400 (0,507)	4,042 (0,689)	4,121	0,616	7 (89)
2	3,962 (0,768)	4,000 (0,782)	4,400 (0,689)	3,979 (0,887)	4,030	0,841	8 (77)
13	4,039 (0,714)	3,838 (0,688)	4,067 (0,591)	3,917 (0,845)	3,936	0,748	9 (72)
3	4,231 (0,764)	3,680 (0,837)	4,133 (0,519)	3,625 (0,866)	3,832	0,831	10 (68)
1	3,920 (0,906)	3,860 (0,787)	4,330 (0,835)	3,604 (1,026)	3,820	0,980	11 (65)
4	3,577 (0,849)	3,730 (0,850)	4,267 (0,882)	3,562 (0,990)	3,736	0,985	12 (62)
7	3,769 (0,816)	3,650 (0,889)	3,930 (0,617)	3,580 (0,732)	3,688	0,892	13 (58)
5	3,808 (0,902)	3,490 (0,786)	3,800 (0,775)	3,500 (1,111)	3,552	0,954	14 (50)

In analysing the results, a weighted scale from 1 to 5 was adopted, where 5 (highest rating) corresponded to A and 1 (lowest rating) corresponded to E on the questionnaire. This enabled the computation of the mean score (MS). The MS was used to establish the relative ranking of the first 14 items on the questionnaire and in conjunction with the Positive Rating Percent (PRP) as an indicator for positive response to an item. In this paper a strong positive indicator to an item was taken to be a PRP of greater than 75 and mean score of greater than 4,00. PRP in this paper is computed by the following relationship:

$$PRP = \left(\frac{f_A + f_B}{N_s} \right) \times 100 \quad (1)$$

where f_A and f_B = frequency of responses to the two highest ratings A and B for that item, and N_s = total number of responses to that item.

Table 2 on the previous page shows the overall rating and standard deviation (in brackets) for a particular item as perceived by the students from each participating institution and also displays the overall ranking of the 14 items in descending order in accordance with the weighted average of the MS for the whole sample. The PRP is also shown in brackets in the ranking column. Generally, highly ranked items will also have higher PRP value, but it is possible to have an item with a lower ranking but a higher PRP. Table 3 tabulates and displays the overall ranking of the 14 items in descending order in accordance with the weighted average of the MS for the whole sample, and shows also the relative ranking of that particular item as perceived by the students from each participating institution.

It is interesting to observe the marked difference in the items' relative ranking by each institution. There is however a relatively general agreement in ranking with respect to item 5, *the*

extent to which the courses covered at the technikon prepared the student for the experiential learning, item 7, *the overall rating of the experiential learning programme*, and item 9, *briefing by supervisor before task was given*. Item 5 has the lowest relative ranking by three institutions and is given the third lowest relative ranking by the fourth institution. Item 7 is the second lowest rated item by three institution and third lowest by the fourth institution. Item 9 has a relatively high ranking by all the institutions. The other items have different relative rankings.

It is important to note that while the immediate impression gained from an examination of the responses to the item 5 is that of lowest relative ranking, the MS of 3,552 is an indication of general satisfaction, though not a strong positive indicator. The item has a PRP of 50, which is indeed low and therefore not a strong positive indicator by the definition in this paper. This reveals that there is room for improvement and therefore academic institutions should pay attention to this item. The fact that item 14, *tasks given were manageable*, and item 10, *whether the students understood the tasks given to them*, are highly rated, might seem to be contradictory to the responses to item 5. An explanation might be found by an examination of the responses to item 9, *the briefing by the industrial supervisor before the task was given to the students*, which shows that it was highly rated by the participants. It had a PRP of 87. This means that the immediate supervisors generally briefed the students before tasks were given. It contributed to their understanding of the tasks to be done and being manageable. It is therefore more of an indication that more knowledge was acquired during experiential training. It is also interesting to note that while the

supervisors briefed the students on the tasks to be performed, the students indicated that they acquired much more new knowledge through the contact with their workmates, item 2, than through their immediate supervisor, item 1.

Item 6, *how often in their view, the given tasks were relevant to the professional growth in civil engineering*, was ranked among the top four by all the institutions. The students felt that the given tasks were usually relevant to their professional growth.

The responses to item 8, *how often the students liked their work*, and item 12, *how often the given tasks offered an opportunity for independent thinking*, indicate that the students usually liked the work they did and that the work given to them usually offered an opportunity for independent thinking. The two items had a PRP of 87 and 86 respectively. Item 11, *how often the work performed stimulated creative thinking*, is related to item 12 and there is a consistency in the students' rating. They found the work given to them to have usually stimulated their creative ability. What is interesting is that in spite of the high rating of the above mentioned items, the overall rating for the experiential learning programme, item 7, is lower with a PRP of 58. It seems that from the students' perception, other aspects should be considered that would contribute to higher rating of the experiential learning programme. An examination of the responses to item 4, *extent to which the experiential learning programme satisfied the students' expectation*, gives a consistent lower rating by the participants from the four institutions.

Item 13, *link between theory and tasks performed*, had a PRP of 72, meaning that 72% indicated there was usually or always a clear link between the theory covered at the technikon and the tasks given to them. The students were thus offered an opportunity to make a linkage between theory and practice and therefore the beginning of the learning process and the acquisition of knowledge. The experiential learning programme is supposed to provide an opportunity for the students to learn in real world settings so that they make the links between the theory and practice of civil engineering. From the results of the responses in this study it therefore appears that the students derived the educational benefit of working in industry. However, 44 students indicated that they would not go back to the same organisation if given a chance to choose where they would do their experiential learning. An analysis was therefore done to explore their rating of some selected items, namely item 6, *how often the given tasks were relevant to professional growth*, and items 7, 8, 9 and item 14, *how often the tasks were manageable*.

Table 3 Overall ranking of selected items on experiential learning

Item	Relative ranking of item				Mean score	Standard deviation	Ranking
	Technikon A	Technikon B	Technikon C	Technikon D			
14	1	3	7	1	4,336	0,625	1
10	8	1	4	2	4,325	0,583	2
9	2	2	2	4	4,266	0,707	3
6	3	4	1	3	4,224	0,735	4
8	7	4	2	5	4,169	0,675	5
12	5	6	7	5	4,161	0,424	6
11	3	7	4	6	4,121	0,616	7
2	10	8	4	8	4,030	0,841	8
13	9	10	12	9	3,936	0,748	9
3	5	11	11	10	3,832	0,831	10
1	11	9	7	11	3,820	0,980	11
4	14	12	10	13	3,736	0,985	12
7	13	13	13	12	3,688	0,892	13
5	12	14	14	14	3,552	0,954	14

The mean scores in respect of items 6, 7, 8, 9, and 14 were 3,880, 3,300, 3,840, 4,000 and 4,472 respectively. Although the mean scores in respect of items 6, 7, 8 and 9 were lower than the overall mean scores, the results indicate that this group of students usually found the tasks given to them relevant to their professional growth, they usually liked and usually to always found the work given to them manageable. Their mean scores also indicate that their immediate supervisor usually briefed them before giving them the tasks. It is clear that the reasons for not wanting to go to the same organisation and the low rating of the overall experiential learning programme, item 7, has little to do with poor supervision, relevance of work, or level of difficulty of the given tasks.

The responses to item 3, which asked the students to rate their contribution to the performance of the section or organisation where they were placed, indicate that the students rate their contribution as moderate to high. At this level, the contribution can only be related to the execution of the tasks given to them and their involvement in the project process. The students felt a sense of achievement and therefore felt they were making a contribution.

Item 17 of the questionnaire dealt with the acquisition of non-technical skills demanded by industry. The students were asked to tick the non-technical skills that they felt they acquired during their experiential learning. Four choices as indicated in table 4 below were given, based on the study by De Lange (1996). The students could tick all of them if they felt their work experience offered them the opportunity to acquire all the skills. The table gives the distribution of hits in per cent per institution for that particular skill.

Responsibility was selected by 86% of the whole sample, followed by communication skills with 68%; 65% selected teamwork. Working in harmony with others had the lowest selection by all the institutions. Overall, 40% indicated that they acquired this skill. It would seem that the working experience was mostly at a professional level.

An examination of the responses of those who indicated they would not go to the same organisation for experiential learning reveals that only 15 of those 44 students selected working in harmony with others as one of the acquired skills during the training. This represents 30% of the total number of students who indicated that they acquired this skill. The author is of the opinion that this could be one of the indicators as to why the overall rating of the experiential learning was low, namely the problem of interpersonal relationships. However, further studies are necessary to pinpoint with certainty whether this is the case.

Table 4 Acquired non-technical skills

Institution	Distribution (%)			
	Responsibility	Communicating effectively	Teamwork	Working in harmony with others
Technikon A	81	65	58	35
Technikon B	86	73	65	49
Technikon C	100	73	87	53
Technikon D	83	63	60	31

In item 18, the students were asked to indicate the type of employer they were placed with. Table 5 shows the type of employer and the distribution of the student placement in each category of employer per institution. Note that in some cases the total number of selections for each institution might exceed the total number of participants from the institution. This is because some students worked for two different organisations in the two six months sessions. In other cases some students did not respond to the item. Most of the students worked for the contractors followed by consultants. Placement mechanisms and therefore the administration of experiential learning are beyond the scope of this study.

However, on the basis of the responses in the present study, it is clear that government departments as well as municipalities could do more to offer training places for experiential learning. Although working for non-governmental organisations (NGOs) might not be seen as prestigious as working for an engineering consulting firm or a large construction company, NGOs could also offer good learning experiences to the civil engineering students, particularly those NGOs involved in community-based public works project (Bizaliele 1997).

As part of the analysis of the questionnaire results, the responses to item 4, extent to which the experiential training satisfied the student's expectation, and the responses to item 7, by those who were placed with contractors and consultants only, were examined. Responses that indicated that the students were placed with both the contractor and consultant, or any combination, during their training were not included in the analysis. The responses to item 4 for those who worked for contractors gave an MS

of 3,885 while the MS for those who worked for the consultants was 3,816, a slight difference. The level of satisfaction regarding their expectations of the experiential learning programme was the same. On the other hand, there was a marked difference regarding item 7.

For those who were placed with contractors, the overall percentage indicating that the experiential learning programme was very good to excellent was 65, while for those who were placed with consultants it was 53%. The MS to this item was 3,783 for those placed with contractors and 3,550 for those placed with consultants only.

The last three items of the questionnaire required that the students make statements about particular aspects of the experiential learning they valued most and what they viewed as problems of the programme. Broadly, the following could be identified:

Positive aspects of the experiential learning

- 1 Learning to be responsible and independent
- 2 The opportunity to experience what the real world of civil engineering is like, being able to be part of a project team
- 3 The opportunity to work with different people and to learn to communicate effectively
- 4 The opportunity to engage oneself at a supervisory level
- 5 Being able to see theory used in practice

The students therefore derived the benefits in non-technical and technical skills through the experiential learning programme.

Table 5 Breakdown of placement by type of employer

Institution	Type of employer				
	Contractor	Consultant	Government department	Municipality	NGO
Technikon A	19	11	–	1	1
Technikon B	16	15	–	3	–
Technikon C	7	4	3	1	–
Technikon D	27	18	6	2	–
TOTAL	69	48	9	7	1

Concerns

- 1 Lack of visitation by the academic supervisor
- 2 Feeling of being undermined and exploited
- 3 Industry does not seem to know fairly exactly what should be covered during the experiential learning period and the extent thereof
- 4 Lack of variation in the given tasks

The lack of visitation by academic supervisors was mentioned by many students, and was more prevalent in one institution. One might ask whether the lack of the presence of the academic supervisor could have contributed to the overall low rating of the experiential learning programme. Certainly, some of the concerns raised could have been addressed had academic supervisors visited the students.

While experiences are usually personal and unique, there are issues that are generally accepted as essential for an individual to have a good training experience. The feeling of being undermined and exploited is not actually a positive stimulus contributing towards a good training experience. One experiences worthiness when one's potential is not only appreciated but is fully utilised. The feeling of being exploited and under-utilised could therefore have an influence on how one evaluates one's own experience.

The breadth of experiences in which the students were engaged seems to be important to the students. It is recognised that it is not possible to cover all the areas at all times as required by academic institutions. Students should be made aware of this. Visitation by the academic supervisor could expose this shortcoming and could further establish the link between the academic institution and industry. In fact, a good relationship between industry and the technikons is essential in order that experiential learning delivers its expected returns for all the participants, the academic institution, industry, and the student.

This study has been based on the view that an investigation of the students' assessment of the experiential learning as a whole is an essential first step in ensuring quality of experiential training being offered and therefore the quality of the whole academic programme. Information about the students' perception of the experiential learning could guide both academic institutions and industry in searching for strategies, which can contribute in their turn to effective development of the programme. The results of such investigation will contribute towards the quality assurance of the programme.

CONCLUSION

The study presented in this paper sought to examine civil engineering students' perception of experiential learning. The study was conducted using a questionnaire administered to 125 students pursuing the National Diploma programme in civil engineering at four technikons. The contribution of this study is that documented students' perception of the experiential learning has been provided. A number of general findings emerge from the study and may be summarised thus:

- The students are usually given tasks that are relevant to professional growth and they usually liked the work they performed. Furthermore, the work assignments given to them usually stimulated their creative ability and usually offered them an opportunity for independent thinking.
- Much knowledge was acquired through the contact with workmates, while it was moderately acquired through the contact with supervisors, although the supervisors usually briefed the students before tasks were given to them.
- While the students usually found there was a clear link between the courses covered at the technikons and the tasks performed, courses covered at the technikons only moderately prepared them for the experiential learning.

There are other issues that surfaced as a result of this study and need to be considered. Regarding the type of work assignments and variation of the given tasks, more guidance for the work place supervisors is required in conjunction with visitations by the academic supervisor. Only by being clear about what is expected of them can the industrial supervisors be intentional and deliberate in their training programmes so as to fulfil the general requirements of the experiential learning as set out by the academic institutions. In this way, the experiential learning should then provide the opportunity to integrate the academic and world of work learning experiences, thus making the programmes relevant and meaningful not only towards professional growth, but also to the students' life in general. However, the students should be made aware that civil engineering is very sensitive to the dynamics of the national economy and thus that the type of work that a firm can offer will be affected by the type of project and work load as determined by the prevailing economic situation. If the academic supervisor makes an effort to know students' progress on their experiential

learning by visiting them, the type of work experience could be negotiated with an industrial counterpart, and other problems that the students encounter can be addressed.

The study has shown that most students are being placed with contractors, followed by consultants. Municipalities, and in particular government departments, could do more to offer places for training. Government departments and municipalities should plan and execute a programme of action that commits them to a comprehensive investment in the training of aspiring engineers through offering experiential learning places. Academic institutions on the other hand should explore further the placement of civil engineering students with NGOs as an alternative to increase placement opportunities, particularly with those NGOs working on community-based public works projects.

The students' concern of feeling undermined and exploited needs to be addressed. The extent to which these issues influenced the students' rating of the experiential learning programme could not be established from this study and therefore should be investigated further. Further research could include variables that influence the quality of the student's work experience and what constitute a good experiential training from the student's point of view.

What the present study indicates is that the students were generally satisfied with their experiential learning programme. There is however a need to improve certain aspects of the experiential learning programme.

Acknowledgements

The author wishes to acknowledge the assistance given in the administration of the questionnaire by Dr H Potgieter, Mr A E Goosen and Mr D P Lange of Peninsula Technikon, Vaal Triangle Technikon and Technikon Witwatersrand respectively and Prof S Long for editing the draft manuscript.

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