Third International Conference on Construction in the 21st Century (CITC-III)
"Advancing Engineering, Management and Technology"
15-17, September 2005, Athens

CONSTRUCTION MANAGEMENT EDUCATION AT UNIVERSITIES OF TECHNOLOGY

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ABSTRACT
In South Africa the higher educational landscape has changed in accordance with government's commitment to transformation and increased access to higher education by all its citizens. Consequently, universities of technology (formally technikons) are charged with the responsibility of delivering instructional offerings that are both relevant and responsive to the needs and priorities of the national economy. These institutions are expected to offer career-oriented educational programs designed to meet the needs of industry and commerce in a high-tech global economic environment. Their approach to education is practical and outcomes-based, with the intent that their graduates are immediately employable and productive. A key component that ensures this productivity is the inclusion into their academic programs of periods of experiential learning spent in industry. Internationally, internships, or service learning form an integral part of construction education while not always compulsory. In South Africa the experiential learning component of a co-operative education construction program is compulsory at universities of technology. Previous studies have shown that South African construction industry employers prefer educational programs that include a period of experiential learning. The views of samples were canvassed nationally using self-administered structured questionnaires of 60 industry participants, 30 academic staff, and 186 third and final year students. This paper reports on the views of the staff and industry samples on the experiential component of construction management programs.

KEY WORDS: University of technology, experiential learning, construction management, cooperative education

INTRODUCTION

As a consequence of the commitment of the government to transformation and increased access to higher education by all its citizens institutions previously known as Technikons were transformed into Universities of Technology from January 1, 2005. They were charged with delivering instructional offerings that are not only relevant but also responsive to the needs and priorities of the national economy. They are expected to offer career-oriented educational programs designed to meet the needs of industry and commerce in a hi-tech global economic environment. Their approach to education is practical and outcomes-based, with the

intent that their graduates are immediately employable and productive. A key component that ensures this productivity is the inclusion of periods of experiential learning spent in industry into university of technology programmes (Haupt 2003). This cooperative education approach has 3 stakeholders namely, the academic institution, employers and students (Haupt, 2003; Smith, 2000; and Rainsbury et al., 1998). It includes periods of academic study alternating with a period of related work experience that arguably prepares students for their class-to-work transition. Consequently, universities of technology need to offer relevant training to adequately prepare their graduates for the world of work.

Cooperative education is an educational approach that links classroom instruction and work for the purpose of enhancing the total educational experience of students (Ryder et al., 1987; Schaafsma, 1996). It therefore involves training and systematically developing students through the acquisition of the requisite skills, attitudes, values and knowledge required to adequately perform in their chosen careers. Many argue that the practical experience gained from a structured internship is an important step in laying the groundwork to prepare students for careers in their chosen field (Hauck et al., 2000; Miller, 1998). Cooperative education thus incorporates productive work into the curriculum as a regular and integral element of a higher education course (Haupt, 2003; Miller, 1998). Experiential learning has long been recognized as among the most effective means of acquiring professional education and training (Tinker and Tramel, 2002; Beliveau and Peter, 2002; Davies, 2000; Hicks 1996). The present university of technology model involves three cooperative partners, namely the academic institution, employer and student. It should therefore be evident that cooperative education has two main components, namely an academic component and an experiential learning component, both of which are integral to its success (Haupt, 2003). Several authors have argued that experiential learning should form an integral part of any Construction Management education programme (Kramer, 2004; Siddiqi and Ozcan, 2004; Hager et al. 2003; Miller, 1998).

Higher education institutions need to develop South Africa into a knowledge based society. At the same time they need to provide education and training to develop skills and innovations necessary for national development and successful participation in the global economy (White Paper, 1997). Universities of technology are in a unique situation to provide students and industry with graduates and diplomats who have not only been educated, but also properly trained in order to participate fully in a society in transition or in need of transformation

Previous studies have shown that South African construction industry employers prefer educational programmes that include a period of experiential learning (Fester and Haupt, 2003). This paper examines opinions of these employers relative to the experiential learning of former technikon construction management students with particular reference to its nature, duration, method of assessment and timing within the academic programme. The paper also discusses the views of academic staff.

METHODOLOGY

Considering that there were growing concerns about the perceived mismatch between industry needs and demand and the graduates produced by Higher Education Institutions (HEIs), a pilot study was conducted to determine the relevance and effectiveness of construction management programs offered by the former technikon sector. The contributions of industry stakeholders at workshops in each of the Eastern Cape and Gauteng provinces informed the development of revised research instruments to determine the knowledge and skills needs of construction management with a view to the eventual formulation and design of an improved model of instructional delivery.

Self administered structured questionnaires were used to canvass the views of 60 industry participants, 30 academic staff, 162 first year students, and 186 third and fourth year students. This paper reports on the findings of the industry and staff surveys. The findings are statistically reported descriptively together with measures of central tendency, particular the means of responses.

RESEARCH FINDINGS

PROFILE OF INDUSTRY SAMPLE

The sample included general contractors (48.9%), project management practices (17.8%), quantity surveying practices (15.6%), consulting engineers (4.4%) and co-contractors (2.2%). These employers worked largely in the Gauteng (30.0%) and Western Cape (24.0%) provinces of South Africa. Most of them (51.1%) had annual turnovers that exceeded ZAR20 million (US$1 = ZAR7 approx.) followed by those (20.7%) with turnovers between ZAR1 million and ZAR5 million. Their average labor force was reported to be greater than 250 employees (24.5%), less than 10 employees (22.4%), and between 11 and 50 employees (20.4%).

PROFILE OF STAFF SAMPLE

Most academic staff (53.6%) surveyed were not professionally registered while 57.1% were involved with some aspect of construction industry related research.

NATURE OF EXPERIENTIAL TRAINING

Most employers considered experiential training to be either necessary (24.1%) or totally necessary (72.4%), confirming the findings of previous studies (Haupt, Smallwood and Miller, 2004; Fester and Haupt, 2003) as evidenced in Table 1. Academic staff expressed similar views, namely necessary (30.0%) or totally necessary (66.7%).

Table 1: Necessity of experiential training

Sample	Totally unnecessary	Unnecessary	Neutral	Necessary	Totally necessary	Mean	Std. Dev.
Industry	1.7%	-	1.7%	24.1%	72.4%	4.66	0.69
Staff	-	-	3.3%	30.0%	66.7%	4.63	0.56

With respect to whether experiential training should be based on a project or function/department based where the student works in the various departments of the employer organization, most employers (70.7%) preferred a combination of both approaches. These findings are shown in Table 2. A smaller proportion of academic staff supported this view (53.3%) with almost third (30.0%) preferring students to be worked through the various departments of an employer.

Table 2: Basis of experiential training

Sample	Project based	Function/	Both	Neither	Mean	Std. Dev.

		department based				
Industry	8.6%	13.8%	70.7%	6.9%	2.76	0.71
Staff	13.3%	30.0%	53.3%	3.3%	2.47	0.78

STRUCTURE AND ASSESSMENT OF EXPERIENTIAL TRAINING

Most employers (82.5%) and academic staff (86.7%) preferred experiential training to be structured as opposed to being unstructured. Industry (89.7%) and staff (93.3%) also required experiential training to be assessed. By ranking the means of their responses the preferences of both samples are shown in Table 3 relative to the method of assessment that should be used.

Table 3: Method of assessment

Method	Industry Ranking	Staff Ranking
Continuous assessment	1	4
Project-based assessment	2	5
Competency based	3	3
Rating sheet	4	2
Term report	4	1
Observation method	6	8
Self-assessment	7	10
Job sponsor assessment	8	6
Portfolio assessment	8	7
Peer assessment	10	11
Panel assessment	11	9

Evidently, while employers preferred competency based forms of assessment, academic staff preferred typically academic forms of assessment of experiential learning. Similarly, employers probably by virtue of being in closer proximity to the work site of students during this period ranked observation higher than their academic counterparts. Industry ranked self-assessment by students of their experience higher than academic staff. This finding hints at preference of the academic institutions to be the custodians of assessment. Peer and panel assessments were the least preferred forms of assessment.

With respect to who should conduct the assessment of experiential training, most employers (74.5%) reported that they should while slightly less (69.6%) thought the academic institution should be responsible. Similar proportions of academic staff (76.0%) agreed to strongly agreed that employers should assess experiential learning. Similarly, slightly less academics (74.1%) reported that they should be responsible. Assessment by an independent assessor was not favourably regarded by both samples. However, there was strong academic staff (80.8%) support for the option of assessment by academics, industry and students. There was no support by academic staff for students to assess their industry experience. Both these options were not presented to industry respondents. The responses of academic staff are shown in Table 4.

Table 4: Assessment agency

Rank	Agency	Mean[1]	Std. Dev.
1	Employer	4.16	1.11
2	Academic institution	4.15	1.17
3	Academic institution, employer and student together	4.12	1.03
4	Independent assessor	2.96	1.37
5	Student	1.83	0.89

TIMING AND DURATION OF EXPERIENTIAL TRAINING

Most employers (76.5%) preferred experiential training to take place in stages. These employers mostly (61.5%) preferred the length of experiential training to be one year in duration. On the other hand, 34.6% preferred the period to be six months long while the remaining 3.8% preferred a 3-month long period in industry. Similarly, most academic staff (80.0%) preferred that experiential learning be undertaken in stages with most suggesting that the total period of time should be either 12 months (77.8%) or 6 months (70.0%).

Table 5: Timing of experiential training

Rank	Timing	Yes	No	Mean[2]	Std. Dev.
1	After year 2	84.0%	16.0%	1.16	0.37
2	After year 1	81.3%	18.7%	1.19	0.40
3	After year 3	71.4%	28.6%	1.29	0.47
4	During year 2	61.5%	38.5%	1.38	0.51
5	During year 3	54.5%	45.5%	1.45	0.52
6	During year 1	45.4%	54.5%	1.55	0.52

The responses by employers to when in the academic program experiential training should be done are shown in Table 5. Evidently, most employers recommended that experiential training take place after the completion of a full academic year. In particular, 84% suggested after the completion of year 2, 81.3% after year 1 which is the present practice, and 71.4% after year 3.

The mean of the responses of academic staff relative to the location of experiential training is shown in Table 6. Evidently, academics (69.5%) agree to strongly agree that the current *status quo* should remain in terms of which students spend the second year of their program in industry.

Table 6: Location of experiential training within academic program

Rank	Timing of experiential learning	Mean[3]	Std. Dev.
1	After year 1	4.09	1.24
2	During year 2	3.45	1.53
3	During year 3	3.00	1.73
4	During year 1	2.80	1.54
5	After year 2	2.80	1.40
6	After year 3	2.41	1.42

[1] On the 5-point Likert scale of agreement, where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. The larger the mean, the greater the degree of agreement with assessment agency

[2] The smaller the mean the greater the support for the timing of the practical experiential learning component of the program

[3] On the 5-point Likert scale of agreement, where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. The larger the mean, the greater the degree of agreement with the location of the period of experiential learning in the academic program

With respect to whether experiential learning should take place before students qualify with a diploma or degree, more employers (70.6%) preferred this training as evidenced in Table 7 to be before completion of a National Diploma than those (64.3%) who preferred before a B. Tech degree. This finding suggests that while employers preferred programs that included experiential training as part of the qualification they wanted this training to take place fairly early in the program but after at least one year of formal academic training.

Table 7: Timing of experiential training before formal qualification earned

Rank	Timing	Yes	No	Don't know	Mean	Std. Dev.
1	Any time before issuing a National Diploma	70.6%	23.5%	5.9%	1.35	0.61
2	Any time before issuing a B.Tech degree	64.3%	28.6%	7.1%	1.43	0.65

While academic staff also preferred experiential learning to occur before qualification with a diploma or degree, more preferred the period to take place before the issuing of a National Diploma (mean = 2.52).[4] This finding is shown in Table 8.

Table 8: Location of experiential training within academic program

Timing of experiential learning	Mean	Std. Dev.
Any time before issuing a National Diploma	2.53	1.65
Any time before issuing a B.Tech degree	1.83	1.29

Relative to how adequately employers were equipped to mentor students during their experiential period in industry the mean response of academics was 3.17 (out of maximum of 5). They reported a mean response of 3.43 relative to how adequately the experiential learning experience of students satisfied their requirements.

REMUNERATION

Most employers (80.6%) were willing to provide experiential training while at the same time remunerating the students. This result is shown in Table 9.

Table 9: Willingness to provide experiential training

Timing	Yes	No	Don't know	Mean	Std. Dev.
With remuneration	80.6%	12.9%	6.5%	1.26	0.58
Without remuneration	50.0%	35.7%	14.3%	1.64	0.74

EMPLOYMENT EXPERIENCE

Slightly more employers (65.5%) had employed B. Tech. Quantity Surveying students than those who had employed (65.4%) B. Tech. Construction Management students. Further, 38.8% of employers had employed both.

[4] On the 5-point Likert scale of agreement, where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. The larger the mean, the greater the degree of agreement with the timing of the period of experiential learning before completion of a formal qualification

Table 10: Performance satisfaction

Student qualification	Most dissatisfied	Dissatisfied	Neutral	Satisfaction	Most satisfied	Mean	Std. Dev.
B. Tech CM graduate	-	-	25.0%	62.5%	12.5%	3.88	0.62
B. Tech QS graduate	-	11.1%	22.2%	50.0%	16.7%	3.72	0.89
ND Building student	-	5.9%	47.1%	35.3%	11.8%	3.53	0.80
ND Building diplomate	-	5.9%	47.1%	41.2%	5.9%	3.47	0.72

Employers reported that they were more satisfied on average (mean = 3.88) with the performance of B. Tech Construction Management students than with the B. Tech Quantity Surveying (mean = 3.72) that they had employed. With respect to which students they would employ again, more employers (85.7%) preferred employing B. Tech Construction Management graduates than B. Tech Quantity Surveying graduates (82.6%).

CONCLUSION

This study confirmed that both industry stakeholder and academic staff respondents regarded experiential training as a necessary component of construction management programs. There was agreement on experiential training in stages with a total duration of 12 months with some support for a shorter period of 6 months. This assessed experiential training period should be structured and include both project and function or department based elements. There were differences in opinion about which assessment methods should be used. However, there was congruence about employers being involved in the assessment of experiential training together with academic institutions. Academic staff reported support for the involvement of all three members in the cooperative education instructional model in the assessment of students' experiential learning experience. There was no support for self-assessment by students themselves. There were also differences in opinion about when experiential training should take place. While employers preferred this period to be after two years of academic training, academic staff preferred the current status quo to remain where students went into industry after completion of one year at the institution. Both samples, however, agreed that it should occur before the completion of any formal academic qualification, more so before the issuing of a National Diploma. Academic staff were not optimistic that employers were adequately equipped to mentor students during their experiential period. They were either neutral or agreed that the practical experience of students during their time in industry was not entirely adequate to satisfy their requirements. Employers were keen to provide remunerated experiential opportunities while most of them were satisfied with the performance of graduates that they had employed previously and would employ them again.

RECOMMENDATIONS

All construction management programs offered at higher education institutions should include a structured period of experiential training preferably 12 months in duration after no less than one year of academic study. This period should include both project and function or department based elements which should be assessed collectively and collaboratively by the employer, academic institution and student. While employers indicated that they were willing to remunerate students during this time remuneration should not be a prerequisite for students to spend time in industry with an employer. Academic institutions together with employers should devise a structured basis of mentoring students in their employ to ensure that the experiential experience enhances the construction management capabilities of the students.

ACKNOWLEDGEMENTS

This material is based upon work supported by the National Research Foundation (NRF) and Education, Training and Development Practices (ETDP) Sector Education Training Authority.

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