

Co-operative Education in Surveying

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Key words: Co-operative education, Surveying, Experiential learning.

ABSTRACT

Co-operative education uses a model that involves all parties in the learning process, namely the student, the educational institution and the employer. It links and integrates higher education with workplace learning experience, provides student motivation and promotes effective learning of the skills required by industry. The major objective is to assist students to develop knowledge and skills not readily attainable in a classroom situation and to obtain practical experience in the workplace with the application of theoretical knowledge gained in formal education.

The paper compares different models of co-operative education, describes the involvement and function of all the participants in this process, the administrative procedure and evaluation of students. It also show that the proper placement of students will lead to more effective employment and subsequent benefits to both employers and employees.

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1. INTRODUCTION

The importance of training and education in South Africa cannot be understated. A large percentage of the population is currently unskilled and even unemployed.

Today's world demands more profit, greater efficiency and lower overheads but without forfeiting quality. Wilson (1986) also showed that the societal forces, productivity and education – industry and academy – are and always have been interdependent. For education to meet these demands the educator's fundamental responsibility is to design, develop and evaluate learning systems that will maximize student performance.

South Africa has two streams of higher education in surveying: firstly the academic education offered by universities which consist of a four-year Bachelors degree followed by Masters and PhD research options. These are designed to prepare students academically for a professional career and professional registration. Technikons, on the other hand, give students the academic background and skills to prepare them for industry. They generally award a three-year diploma or four-year B.Tech. degree, followed by applied research for M.Tech. and D.Tech. qualifications. The basic qualification usually comprises co-operative education.

2. DEFINITION

Co-operative education uses a model that involves all parties in the learning process, namely the student, the educational institution and the employer, and fits in well with the new converging perspectives of teaching and learning. It links and integrates higher education with workplace learning experience, provide students with motivation and promotes effective learning of the skills required by industry. According to Bitzer *et al* (1999) the work experience involves a definite period or periods of employment supplementing full or part-time study on campus. Hall (1999) adds, "... the feature that distinguishes successful co-operative education from other essentially unintegrated work-study programs is the extent to which the two elements of formal study and work are integrated as full partners in the learning process and the college curriculum." Evaluation of the experience and the learning that took place is performed by all participants (student, employer and institution).

Co-operative education implies a partnership between student, training institution and the employer – a formal relationship illustrated in Fig. 1.

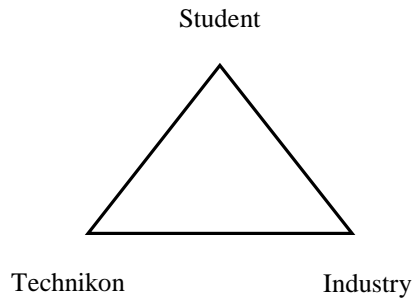


Fig. 1 The co-operative education model.

It consists of periods of academic education and experiential learning (training in industry). The different components of co-operative education are shown in Fig. 2. Formal training modules refer to training opportunities with clearly defined aims and objectives. The progress of the student's development and competencies are measured against predetermined criteria. Work experience (informal training) refers to the experience gained by exposure to the real life of the actual work situation. Career experience refers to those aspects to which the student is exposed during his experiential training relating to career development, such as lines of authority and his position in the company.

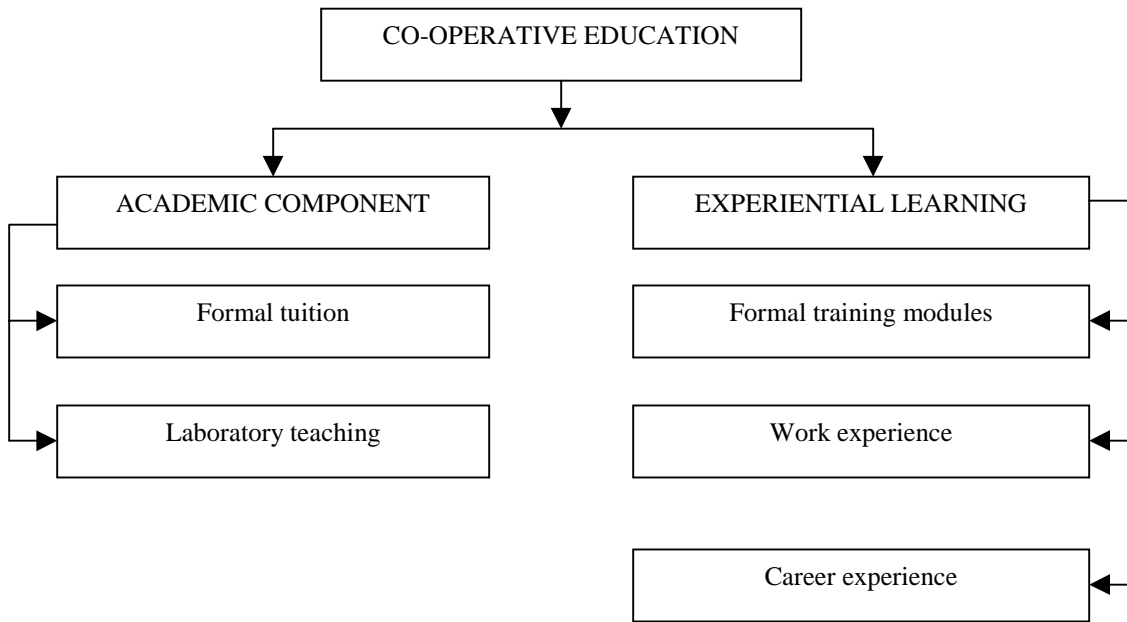


Fig. 2 The different components of co-operative education.

3. AIMS AND OBJECTIVES OF CO-OPERATIVE EDUCATION

Coleman (1998) have shown that graduates are not immediately productive, nor are they adaptable within a changing marketplace. Their greatest returns were found to be after specific skills training. The South African Society for Co-operative Education (2000) therefore list the purpose of co-operative education as:

- To compile a career oriented course which satisfies the needs of the students as well as industry
- To assist students to develop the knowledge and skills which cannot be achieved in a classroom situation and to apply theory to practical applications
- To focus academic content of the most recent technological developments on the relevant needs of commerce and industry
- To assist students in the transfer from higher education to a career and to develop the skills necessary in a successful career
- To guide students to master skills in independent work, effective communication, analysing, innovation, synthesising and integrating situations in the work environment
- To establish contacts for future employment

This will ensure a smooth and efficient transition from the classroom to the workplace, i.e. to match the student's expectations with the employer's needs as effectively as possible.

The development of the following core skills should take place during the period of experiential learning:

- Communication skills, which relate to the ability to produce written and spoken communication appropriate for a range of purposes and audiences
- Numeracy skills, which is the ability to use a range of fundamental arithmetical and mathematical skills to reach conclusions in a range of situations
- Information technology skills which refers to the ability to use new technology to input, process and output information and to perform basic operations
- Problem solving skills, which relates to the ability to identify and clarify the nature of problems, to plan and implement strategies to address problems and evaluate the effectiveness of strategies and solutions.

An academic programme has one master, namely the university itself. The quality of an academic department is determined by its research output, the quality of its teaching and the community service undertaken by its staff (Hannah 2000). However, a professional degree programme has a second master, namely the professional body to whom it supplies graduates. They are far more concerned with the expertise of the graduates, rather than their research ability. In other words, a well-taught graduate is perceived to be of greater value than one with advanced research skills. Co-operative education tries to accomplish both these requirements.

4. DIFFERENT MODELS

Some models have more than one period of experiential learning (usually consisting of one semester each), while others have one continuous period, which may occur at various stages in the academic programme. Fig. 3(a) shows a three-year diploma course consisting of 3 semesters of formal academic education, alternating with 3 semesters of experiential learning. The sequence may also be reversed. The advantage of this model is that theory can be applied in practice shortly after it has been covered in the class. All Surveying and Engineering programmes at South African technikons used this model until 1990. However, one semester is often too short to be involved with the completion of a whole project.

In 1991 all Surveying and Engineering programmes shortened the experiential training component to one year and changed to the model shown in Fig. 3(b). The advantage of this model is that the students spend a full year at an employer during which time they would be able to complete a variety of projects and learn the operation of the company. The premise of this model is that the theory that the student learnt in the first year is applied in industry in the second year, and these practical applications will assist him in the advanced theory in third year. In some cases it is also possible to do the first and third academic years consecutively with the experiential training at the end, although this is not ideal.

Some programmes, especially in the Commercial sciences, do not have a compulsory experiential training component. Many of them make use of a flexible system where the student spends a few weeks in industry at the end of every academic year, as shown in Fig. 3(c). Whichever model is used, the objective should always be to improve the student's insight and understanding of the theory, so that he can apply this in practice.

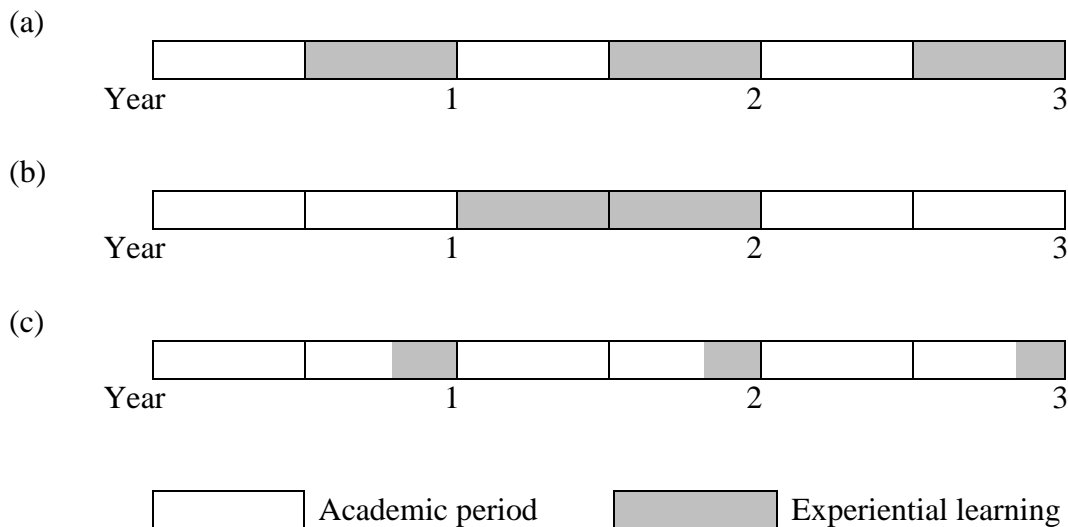


Fig. 3 Comparison of different co-operative education models

The period spent in practice is not so important. What is important is whether he covered all the aspects in the syllabus, and whether he has acquired the necessary skills. Therefore the evaluation of this training is essential. Schneider (1998) pointed out that a technician should be able to practice as soon as he is qualified. He will be specialized, with emphasis on the use of instruments, spatial data acquisition, data management and data presentation.

Competencies must be translated by employers into a series of tasks. These tasks must be performed within a specific working environment in industry. This working environment is defined by a series of projects or subject areas.

Project work may be used to enhance experiential training. The projects should be carefully planned as follows:

- Proficiency in mastering processes are best acquired by self activity
- To master a project, a clear procedure must exist
- Solutions to projects must be open ended
- To progress, a student must achieve success
- Projects should enhance the opportunity of self-discovery
- Teamwork should be required to complete projects.

5. EXPERIENTIAL LEARNING CYCLE

For a co-operative education programme to be successful it must be managed properly. To ensure that the experiential learning is fully integrated with the academic component, the following procedure must be adhered to.

5.1 Administration

A coordinator is appointed by the Technikon, who may be an academic or a person in the Co-operative Education Department. His primary responsibility is to coordinate and supervise the co-operative employment of an assigned group of students. Some of his functions include: briefing students on experiential learning positions; liaison with industry to secure suitable training positions; briefing students on what is expected from them during experiential training, i.e. course content; briefing students on work ethics and interview skills; referring students on an individual basis to possible employers; visiting students in the workplace to monitor their progress; referring problems identified by employers to the Head of Department.

5.2 Guidelines

Clear guidelines must exist, or even better, a formal syllabus compiled jointly by the Technikon and the employers giving course objectives for the experiential learning. This syllabus must be an integrated component of the academic programme, which is also compiled jointly.

To ensure the best possible results of the experiential training programme, the guidelines must contain the following information:

- The mission of the Technikon regarding co-operative education
- Properly formulated goals
- Specific requirements for the particular academic programme
- Responsibilities and tasks of the participating parties
- The administrative procedure

5.3 Orientation

Students are prepared for the experiential learning period by reviewing the philosophy of co-operative education, assisting them to write a CV, creative job searching, giving guidelines in the art of interviewing, providing the course requirements and assessment procedure. The roles of the Technikon coordinator and employer supervisor will be explained and the requirements for the presentation of the final report for evaluation.

5.4 Placement of Students

The Technikon will endeavour to find suitable training positions for students. The following are some of the criteria to be used in the selection of a training station:

Career goal: The training should be relevant to the academic programme and cover sufficient scope and depth of material. It should provide experience that requires both skills and knowledge. It should provide a wide variety of experiences. If all the compulsory components of the programme are not covered, the opportunity must exist that the student can be seconded to another employer.

Supervision: Training should be supervised by someone qualified and competent in the relevant aspects of the occupation.

Reputation: Establishments that furnish training stations should have a reputation of ethical business practices, and should not misuse students as cheap labour.

Facilities: Up-to-date facilities and equipment should be used.

Wages: Because the experiential training is part of the educational programme, students cannot expect a large salary. However, the employer should pay some allowance.

Several methods of placement are possible. These are:

1. All interested students are allowed to apply at a specific training station.
2. One student is selected and then others are successively chosen if the first one is not hired.
3. Several suitable students are sent for an interview.
4. The students are allowed to find their own jobs, subject to the coordinator's approval.

If the career objectives have been well defined the first method allows for the most natural competitive employment situation and leaves the final choice with the employer. In the second case, the coordinator is almost choosing a particular student for a particular training station even though the employer has the option of not selecting the candidate who comes to

the interview. In the third case, where several are sent for an interview, an initial selection is made by the Technikon to match a student with an employer – this would be the ideal option because the employer would only interview a few students, but he still makes the final selection. The weakest method is the last one, where students are allowed to find their own jobs. This may result in plain work experience, and not properly managed training programmes.

Job development is the act of creating jobs (training opportunities, part-time employment or full-time employment) that did not exist or whose existence was not previously known to the Technikon. It is to find positions in industry that will provide the learning experiences needed by students and that will convince business persons that they will benefit by cooperating. Job development is an aggressive, not a passive function.

We are currently setting up a website where each student will have his own web page containing his CV, academic results and particular interests. This can then be used by employers to make an initial selection of candidates.

5.5 Monitoring & Mentoring

During the period of experiential learning a supervisor/mentor is allocated by the employer and a liaison officer or coordinator by the Technikon for the students.

The tasks of the liaison officer are to

- Visit employers to identify both training and education needs
- Visit companies to identify possible employers
- Monitor and assess the performance of students on a regular basis. This may lead to the identification of problems or gaps in the training programme, which must be resolved in discussions with the student and the employer.

Each visit should include discussions with both the student and the employer. One of the most important objectives of the visit is to obtain the employer's assessment of the student's performance. Feedback will be obtained from the employer on the contents and relevance of the academic and experiential learning components of the programme. Any problems identified will be referred to the Head of Department.

The function of the mentor is to guide the student in his learning process. Mentoring is a deliberate pairing of a more skilled or experienced person with a lesser skilled or experienced one, with the agreed-upon goal of having the lesser skilled person grow and develop specific competencies.

5.6 Evaluation

To ensure that the goals and objectives of the co-operative education programme are met, a systematic approach to educational evaluation is followed by evaluating the student's acquired skills. Experiential learning is evaluated by:

- The supervisor at the training facility, who will determine and certify the level of competence achieved by the student
- The liaison officer who monitors student's performance and ensures that the prescribed syllabus is completed
- The head of department who will conduct an interview with the student to ensure that the academic goals of the programme have been met. This also entails a class presentation.

This evaluation cannot be a once off situation, but must be an ongoing process.

6. ADVANTAGES

The advantages of co-operative education for the students are:

- It offers an integrated learning experience which integrate the theoretical and practical components
- It exposes the students at an early stage to the career so that he can decide if he has made the right career choice – changes at this stage will not be as expensive or far-reaching as changes made after completion of studies.

One of its most underrated advantages is its potential to assist students with evaluating and acquiring employment opportunities (Bitzer *et al* 1999).

Because of the close co-operation between the Technikon and industry, it ensures that the education carried out by the technikon meets the requirements and needs of industry. Students who had exposure to industry are more rigorous in details and verify their calculations systematically (Schneider 1998). They show more care in presenting their results because their previous experience taught them the importance of making a good impression on their clients.

An important advantage for industry is that it offers an ideal recruitment method because the employer has a realistic opportunity to evaluate the actual work performance of the candidate. It therefore improves the average retention rate among permanent employees recruited and hired through the co-op programme. It assures industry that prospective employees have skills that make them immediately productive; they are not merely theory-qualified graduates.

For registration as a survey technician, a certain period of prescribed practical training is required. The Technikon has ensured that this requirement is incorporated into our experiential training component. When a student completes his diploma, he will then also comply with the requirements for registration as a survey technician with the South African Council for Professional and Technical Surveyors.

Regular contact between the Technikon and industry is ensured. An advisory committee consisting of industry representatives meets annually to advise the Technikon on industry requirements and possible curriculum improvements. This ensures a client-driven service.

7. PROBLEMS

There are often mutual suspicion and distrust between educational institutions and industry. Industry view colleges and universities as producers of overly theoretic, impractical and unprepared graduates who must be trained before they are productively employable, and as agonizingly slow to respond to human resource needs and as sometimes narrowly arrogant, wanting corporate money for curriculum development and research, but no advice. On the other hand, educators often regard employers as seeking short-term solutions to problems and making decisions driven too much by the profit motive.

Especially during times of economic decline there are a lack of experiential training positions. This often leads to lack of motivation among students who perceive that they will not be able to get experiential training. To alleviate this, the co-op department at the academic institution has to do its best to assist students to find employment – even if it is only for short periods at a time, or even for a very low, or no salary.

A few years ago the Dept. of Civil Engineering at the Cape Technikon conducted an experiment by offering a year of simulated practical training to students who could not find employment. This was not very successful because some types of work cannot be effectively simulated. Training in design was found to be adequate, but not training in construction (Colling 1994).

During the 1980's most students were sponsored by an employer for their studies – this employer also provided experiential training and usually a permanent job after completion of their studies. Recently this has changed, in that most students are paying for their own studies and are not permanently employed until after their studies. This is partly due to the economic climate, but also in this way the employer can better evaluate a candidate before employing him.

8. QUALITY ASSURANCE

To ensure that the objectives have been met and that the programme is fit for purpose, not only the programme but also the experiential training component should be subjected to quality assurance. According to Burnett & Clarke (1999) the following people should be involved in the course evaluation:

- *Students* – they are paying for the service and are also in the best position to judge the quality – it could be done by questionnaires and interviews. Student progress and course completion rates must also be considered.
- *Graduates* – once they have completed the course and obtained experience in the workplace they are in the best position to determine the relevance of course content.
- *Employers* – they benefit from high quality training and are able to evaluate the competence of the students.
- *Academics* – this is done by self and peer evaluation.

All the components of experiential training, e.g. administration, contents, evaluation, student expectations, learning outcomes, etc. is just like the academic component submitted to regular self evaluation and external quality assurance.

9. CONCLUSIONS

Hall (1999) predicts that the co-operative student of the future will work and learn at the same time. Students currently in work will pursue one or more courses from wherever they are working as an on-line study. Students at a campus will pursue a work-related project for an employer. These projects could also become the term projects for the course. Students will have to experience a wide variety of work situations, preparing them for different and frequently changing jobs.

Frank (1995) list the following areas where survey education could be improved:

- Graduates lack communication skills. They are not able to present the results of their work convincingly in oral or written form.
- Graduates are not experienced working in a team with others.
- They do not understand the business aspects of their work.

All these areas could be partly addressed during the experiential training. By its very nature co-operative education is designed to fulfil the educational needs of survey technologists and provide the skilled personnel required by industry. It is not the only educational model, but it provides for a definite demand.

REFERENCES

- Barthorpe S. & Hall M. 2000. A Collaborative Approach to Placement Preparation and Career Planning for University Students: a case study. *Journal of Vocational Education and Training*. 52(2). pp.165-175.
- Bitzer E, Kapp C & Engelbrecht L. 1999. Mainstreaming “Cinderella”: the potential of co-operative education in strengthening the principles and objectives of the NQF in Higher Education. *South African Journal of Higher Education*. 13(2). pp.7-13.
- Burnett P.C. & Clarke J.A. 1999. How Should a Vocational Education and Training Course be Evaluated? *Journal of Vocational Education and Training*. 51(4). pp.607-627.
- Coleman D.J. 1998. Academic Geomatics into the Twenty-first Century: A North American Perspective. *Geomatica*. 52(1). pp.11-24.
- Colling N. 1994. Co-operative Education in times of High Unemployment: A Cape Technikon Perspective. *Journal of Cooperative Education*. 30(1). pp.26-35.
- Esterhuysen J. C. 1995. A Structured method for Effectively Administering An Experiential Training Syllabus. *Proceedings of the world conference on Co-operative Education*. Jamaica.
- Frank A. U. 1995. Surveying Education for the Future. *Geomatica*. 49(3). pp.273-282.
- Hannah J. 2000. Surveying Education in the New Millennium: The Challenges. *Trans Tasman Surveyor*. 1(3). pp.10-15.
- Hall J W. 1999. Cooperative Education for the Future. *Journal of Cooperative Education*. 34(2). pp.9-15.

- Schneider J. 1998. Two Complementary Ways: the Academic and Engineering Educations. *Proceedings of the 21st International FIG Congress*. Brighton. pp.343-350.
- South African Society for Co-Operative Education. 2000. *Best Practice in Co-Operative Education*. Durban.
- Wilson J. W. 1986. Analysis of Cooperative Education as a work/education joint venture. *Journal of Cooperative Education*. 21(1). pp.29-39.

BIOGRAPHICAL NOTES

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