Global J. of Engng. Educ., Vol.7, No.2
Published in Australia

Problem-Based Learning (PBL): From the Health Sciences to Engineering to Value-Added in the Workplace*

Melissa D. Northwood
St Peter's Hospital, 50 Charlton Avenue East, Hamilton, Ontario L8N 4A6, Canada
Derek O. Northwood
Department of Mechanical, Automotive and Materials Engineering, University of Windsor, 401 Sunset Avenue, Windsor, Ontario N9B 3P4, Canada
Marilyn G. Northwood
Right Axmith, Walker Business Centre, 3270 Electricity Drive, Windsor, Ontario N8W 5J1, Canada

In North America and globally, a student-centred PBL learning approach is utilised in many schools of nursing and medicine, and is gradually being integrated in to engineering programmes. PBL involves students working in small groups to analyse problem situations as a basis for acquiring knowledge, skills and attitudes. The skill set required of engineers has changed towards one of design, problem-solving, teamwork and communication. The changing demands of the accreditation process also call for a parallel change in curriculum planning from a teacher-centred pedagogy to a PBL approach. Engineering graduates from a PBL programme will be better suited to the changing nature of the workplace as self-directed and life-long learners. This paper will discuss the research evidence regarding PBL in the health sciences and engineering literature, its applications to engineering schools, and the potential impact on the global workplace.

INTRODUCTION

In this age of booming information technology, graduates of engineering programmes are expected to be quick learners, adaptable, current in their knowledge and also be innovative. This age also requires engineers to be flexible, life-long learners. In the words of a chemical engineer, Donald Woods,

> *Learning subject knowledge today is not sufficient for challenges of tomorrow. You will need to keep yourself up to date. You will need to learn new knowledge each week of the rest of your life* [1].

Another educator, Loris Malaguzzi, stated:

> *Learning and teaching should not stand on opposite banks and just watch the river flow by; instead they should embark together on a journey down the water. Through an active, reciprocal exchange, teaching can strengthen learning how to learn.*

Simply put, engineering graduates and engineering professors need to give thoughtful consideration to current pedagogical approaches. Do engineering graduates have the comprehensive skill set necessary to take on this brave, new booming world?

Problem-Based Learning (PBL) education is the curricular answer to meet the needs of the changing global workforce. A student-focused PBL curriculum will enable educators to successfully chart the course of engineering amid the turbulent *river* of current times.

PBL DEFINED

PBL education has two main components: the starting point is a problem; and a student-centred approach that affords students control over and responsibility

*A revised and expanded version of an Opening Address presented at the 6^{th} *UICEE Annual Conference on Engineering Education*, held in Cairns, Australia, from 10 to 14 February 2003. This paper was awarded the UICEE diamond award (joint first grade with one other paper) by popular vote of Congress participants for the most significant contribution to the field of engineering education.

for their own learning [2]. This is in contrast to traditional programmes that are teacher-centred, where the teacher or textbook determines what the student should know [1]. The teacher in PBL is the facilitator, coach, or *guide on the side*, rather than the *sage on the stage*. The PBL curriculum is organised around a series of problems and the conditions for learning favour self-directed learning, group work, critical thinking and self-reflection [2].

Exploring the literature on PBL reveals that many words are used to describe this teaching method: research project; case method; design project; experiential encounter; project-oriented; cooperative learning; explanation-based learning; active learning; or small group learning [1]. This is not even an all-inclusive list. No matter how it is described, essentially PBL is *Learning which results from the process of working towards the understanding or resolution of a problem* [3].

PBL was originally conceived to involve small groups of five to ten students with a faculty member as the tutor. This is the structure at many Canadian schools of nursing and medicine. However, PBL has been adapted to large groups, particularly in engineering programmes [2]. For example, this is the application in the chemical engineering programme at McMaster University, Hamilton, Canada.

PBL curricula can also include tutorless groups or groups with a *wandering tutor* [4]. In the case of the tutorless groups, students' group process and facilitation skills are developed first in order for students themselves to lead a group. The wandering tutor scenario generally involves a faculty member as the tutor being available to many small groups that operate concurrently in one classroom. Thus, PBL can be integrated into an engineering curriculum along a continuum from completely integrated problems to a hybrid curriculum where several PBL classes are offered with lecture courses [2].

The PBL process consists of six steps, as follows:

- Exploration of the problem and generation of hypotheses;
- Identification of learning issues (based on prior knowledge) and information sources;
- Information gathering and independent study;
- Critical discussion of the knowledge acquired (in a group setting);
- Application of knowledge to solve the problem;
- Reflection on the process and provision of feedback [1][2].

This process is distinctly different than a traditional approach. In a traditional programme, students embark on learning by being told what they need to know, learning it and then being given a problem to illustrate how to use what they have learned [1]. This is a linear, teacher-centred process. Conversely, in PBL, the learning begins with a problem, students identifies what they need to know, they learn it, they apply it to the solution of the problem and, most likely, they generate more problems and more learning needs in this cyclical process [1].

The theoretical rationale for the PBL approach is rooted in cognitive psychology. Prior knowledge is an important determinant of the amount and type of new knowledge that can be integrated and this prior knowledge needs to be activated in the context of information being studied [5]. Thus, by starting with a problem, the student is able to identify his/her learning needs and structure the acquisition of new knowledge accordingly.

The way knowledge is structured in the memory ultimately affects its ability to be retrieved. This is the dilemma often seen in traditional programmes. Students cannot use knowledge they have learned from a lecture or a textbook in the practice setting [5]. The ability to use this memory depends on contextual cues; the use of a problem around which to organise knowledge provides such a cue and facilitates recall of the information [5]. Education based on a philosophy of PBL is a building process that is exciting and motivating to the adult learner.

The PBL process was first developed as an alternative to traditional medical education and was implemented in 1969 in the medical school at McMaster University [2]. PBL curricula have spread worldwide in many other disciplines, such as engineering, but also including nursing, architecture and business [1][2].

Due to the prevalent use of PBL, particularly in health sciences education, a significant amount of published research exists to support its use as an effective curriculum design.

SUPPORT FOR SELF-DIRECTED LEARNING: RESEARCH ON PBL

The main question raised by the engineering educator is *will PBL work?* Many studies in both the health sciences and engineering have sought to answer this question. These studies will be summarised using Kirkpatrick's hierarchy levels of evaluation [6]. It should be noted that Kirkpatrick is a medical educator.

The levels of evidence range from the simplest to most complex: participation, reaction, learning, performance and impact. Studies that evaluate participation look at whether or not students attended class. An examination of reaction involves determining how students feel about PBL. Learning is typically measured by standardised tests of gains in knowledge. Performance evaluates actual changes in students' behaviours. An evaluation of impact is the most important – yet challenging – to measure, as it looks at the impact a PBL curriculum has made on the delivery of engineering services. No literature could be located on this topic; it is certainly an unexplored area.

In the medical literature, the reaction of students and faculty in medical and nursing schools using a PBL approach has been addressed in six qualitative studies and six quantitative studies [2]. PBL students tend to rate their experiences more favourably than their traditional programme counterparts. Studies of faculty have found that the opportunity to interact on a more personal level with students was cited as a primary source of satisfaction [2].

Limitations to the PBL approach were noted by students and included: concern whether they were learning all of the essential content, problematic group process issues and inconsistent expectations of faculty. Faculty described the loss of control and difficulty with evaluation as limiting factors to their satisfaction [2].

The bulk of the engineering literature on the reaction of engineering students to a PBL curriculum has been done at Aalborg University in Denmark [7]. A large-scale evaluation of PBL was undertaken utilising questionnaires to study the reactions of students, employers, graduates and external examiners. It was noted that students:

- Chose to go to Aalborg because of PBL;
- Are enthusiastic about group work;
- Felt PBL prepared them for graduation;
- Felt better prepared in management, cooperation, problem-solving, teamwork, and general technical knowledge [7].

In addition, the external examiners felt that students' project work prepared them beyond technical information. The employers felt that the strong interaction with private companies during the project work was very beneficial and that PBL students were more cooperative. Half of the graduates, practicing engineers, felt that the source of their professional knowledge was from the project work. Students did express some concerns, namely that they felt worse prepared in detailed textbook and fundamental knowledge and described a feeling of *diffuseness* about technical coherence [7].

In summary, engineering and health science students and faculty rate PBL positively; they enjoy the educational process.

To evaluate the learning outcomes of PBL in the health sciences, Albanese and Mitchell conducted a meta-analysis of all printed studies with PBL in the title published between 1972 and 1992 [8]. The evidence from this review was slightly in favour of non-PBL programmes when outcomes are measured with traditional multiple-choice tests [8]. More recent evidence suggests that the differences may actually not be significant [2].

In engineering research, external examiners surveyed in the Aalborg experiment found no differences in the level of thesis work between PBL and traditional students. Eighty percent of Aalborg graduates pass their final exams and have a lower dropout rate than traditional engineering programmes in Denmark [7].

With respect to actual performance, the bulk of the research has been done in the health sciences where PBL curricula have been in place longer and more consistently. PBL learners in medical programmes demonstrated better clinical performance [2]. Another study of nursing students reported that PBL students felt better prepared in communication and self-directed activity, but that there was no statistically significant difference in their perceived abilities related to clinical functioning and decision-making [2]. Self-directed learning and life-long learning are skills in which PBL students perform exceptionally well [2]. PBL students spend more time in the library, check out more library books, and use a wider variety of written materials [8]. PBL students also place greater emphasis on journals and online literature searches [2]. These behaviours suggest that a PBL curriculum promotes life-long learning abilities in students.

Much more quality research is needed on the subject of empirical support for PBL. In particular, the performance of engineering students in PBL curricula warrants examination. Also, neither the health sciences nor the engineering literature report studies of the impact of PBL educated employees on the delivery of health care and engineering services.

Summing up, the faculty and student reports of satisfaction suggest PBL is a viable and stimulating method of education. Being satisfied with the curriculum facilitates motivation, which prolongs time at study, and should positively influence achievement. In addition, working in small groups facilitates the development of collegiality [9]. The PBL process means students are working together to solve problems by dealing effectively with disagreements and conflicts of opinion. These are skills that are critical in the workplace in these times of tight resource allocation and competitive markets.

A PBL curriculum is a logical fit for developing this required skill set for engineers of problem-solving, teamwork and effective communication, as has been stated:

> [PBL] *has been introduced because of a new emphasis on producing a* well-rounded *graduate, ie someone with not only a sound knowledge of engineering science, but also a whole raft of vital professional skills and a creative and enquiring mind* [3].

ENGINEERING CURRICULUM AND PBL

With a number of notable exceptions, most engineering programmes have been based on a very traditional curriculum and way of teaching [10]. The curriculum consisted of a number of subjects (eg mathematics, physics, mechanics, thermodynamics, etc), normally five to seven per semester. Almost all were taught using traditional classroom teaching methods; some subjects were taught in combination with laboratory experiments [10]. Each subject was taught by an individual teacher with an examination for each subject at the end of the semester. These subject cores are isolated from each other by strict boundaries and the student studies the theory first and then attempts to apply it in practice [11].

In contrast, the notable exceptions are found internationally in engineering education. At McMaster University, the engineering programme has used a PBL approach for the past 20 years. Prior to the initiation and development of this PBL programme, engineers Crowe and Woods examined the undergraduate programme by participating in classes to determine what the students were learning and where the specific difficulties were with course content [12]. Aalborg University implemented a PBL curriculum in 1974 [7]. Monash University in Australia and the University of Manchester in England have programmes and courses with a PBL curriculum [3][13]. In Singapore, both Temasek Polytechnic and the Republic Polytechnic have completely PBL curricula for computer, electrical and industrial systems engineering diploma programmes [14][15]. Other universities across the world do have courses in their engineering programmes that are conducted with a PBL approach [16].

The movement towards a PBL approach has erupted from the considerable examination and criticism of the traditional approach. Dr Bill Wulf, the current President of the National Academy of Engineering in the USA, states that the traditional engineering curriculum has not been fundamentally updated since World War II and, therefore, has not kept pace with rapid changes in engineering brought about by advances in technology [17]. He stresses that it is important for engineers to appreciate the human dimensions of technology, understand global issues, be sensitive to cultural diversity and know how to communicate effectively. Many students graduate deficient in these areas and companies often need to invest one to two years in on-the-job training to fully prepare engineering graduates for the workplace [17].

Another compelling argument on the need for a change from the traditional curriculum has been proposed by Moesby [18]. He suggests that the one problem facing modern engineering education is how to adapt quickly to an ever-changing world and to keep up with an almost exponential growth of knowledge. He argues that the knowledge that students can acquire within a given timeframe is limited, so they will know relatively less of the current knowledge available when they finish at university, compared with the knowledge present when they actually started. He argues that we must endow students with the skills and competence to seek and utilise new knowledge independently.

Furthermore, Dale, in his *Cone of Learning* model, suggests that people learn and retain 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say, and 90% of what they experience directly or practice doing [19]. This concept is very much in keeping with an old Chinese proverb, which nicely summarises the difference between traditional subject-oriented education and the project-oriented educational model of PBL [20]:

Tell me and I will forget
Show me and I will remember
Involve me and I will understand
Step back and I will act.

In PBL, the learning process is based on a real life problem, such as the workplace or research setting [21]. PBL gives the students the responsibility and opportunity to identify what kind of information they need and how to combine facts and knowledge from different areas in order to find out how problems can be solved. Perhaps Winston Churchill summarised this best of all: *I am always ready to learn although I do not always like to be taught*. PBL students learn to be and become self-evaluating. All of these abilities are key skills for their future working lives [17].

ENGINEERING ACCREDITATION: PBL IS CENTRAL

The accreditation criteria in North America have been evolving over recent years, but have undergone far greater changes in the USA than in Canada. The

Accreditation Board for Engineering and Technology (ABET) system in the USA has moved to an outcomes assessment approach rather than the prescriptive approach still taken by the Canadian Engineering Accreditation Board (CEAB) in Canada, where the curriculum is defined in Accreditation Units (AUs) in mathematics, basic sciences, engineering sciences and engineering design, and complementary studies [22][23].

ABET requires engineering programmes to demonstrate that their graduates have the following:

- An ability to apply knowledge of mathematics, science and engineering;
- An ability to design and conduct experiments, as well as to analyse and interpret data;
- An ability to design a system, component or process to meet desired needs;
- An ability to function on multidisciplinary teams;
- An ability to identify, formulate and solve engineering problems;
- An understanding of professional and ethical responsibility;
- An ability to communicate effectively;
- The broad education necessary to understand the impact of engineering solutions in a global and societal context;
- A recognition of the need for, and an ability to engage in, life-long learning;
- A knowledge of contemporary issues;
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Although some of these outcomes can be achieved by the traditional use of lectures and homework assignments, a more powerful approach is to implement a PBL-based engineering programme that meets all of these objectives and develops students' ability to function on multidisciplinary teams [24]. Although the CEAB criteria are not as focused on the outcomes assessment, there is an increasing acknowledgement in the criteria of need that the engineer:

- *Be adaptive, creative, resourceful and responsive to changes in society, technology and career demands* (Section 2.1.3).
- *Be aware of the role and responsibilities of the professional engineer in society and the impact that engineering in all its forms makes on the environmental, economic, social, and cultural aspirations of society* (Section 2.1.4).
- *To function as an effective member of a team and to be able to communicate both within the profession and with society at large* (Section 2.1.5) [23].

Many of these needs can be satisfied better when the engineer has undertaken a PBL-based programme as a student rather than a *traditional* programme.

VALUE-ADDED IN THE ENGINEERING WORKPLACE

The skills and knowledge base that engineering students of a PBL curriculum acquire directly affect and enhance their ability to be more successful engineers upon graduation. The skills demanded by employers today have changed radically with the technological explosion. Good reading and writing skills are no longer enough. The skills essential in today's worker also include: computing, speaking, listening, solving problems, managing oneself, knowing how to learn, working as part of a team, and leading others [25]. These skills are not readily developed and fostered in most traditional engineering programmes. It seems counter intuitive that universities remain some of the most conservative institutions. Why have teaching practices and curricula not changed at the same rate as the workplace?

However, as already noted, a PBL curriculum does develop these essential skills that employers are demanding. PBL gives students the responsibility and opportunity to:

- Identify what kind of information they need;
- Combine facts and knowledge from different areas;
- Find out how problems can be solved;
- Be self-evaluating.

As demonstrated in the health sciences literature, PBL students are life-long learners, and this is critical in ever-changing workplaces. The life-long learner will continually be updating his/her knowledge base and know-how and where to access this required information.

In addition, PBL students have studied real-life problems and have gained better insight into what to expect from their profession and what kind of knowledge will possibly be needed [11]. By learning the theory component in the context of a real-life problem, the student has better developed the cognitive structures that are needed to retrieve this information for its future use and application in the workplace.

Of particular importance are the group work skills that PBL engineering students develop. By working in small groups to tackle real-life problems, collegiality and teamwork skills are developed [9]. There is a process of collaborative learning where the emphasis is having students work together to get a job done [9]. For example, this would be similar to what they would experience in the actual workplace. The collaborative skills that students must have and use include: leadership, decision-making, trust building, communication and conflict-management skills [24].

Finally, PBL students are more confident and feel better prepared to graduate [5]. All of these abilities are the key skills and attributes needed for success in the engineering workplace. Aalborg University is a pioneer in the field of PBL-based engineering education [26]. They have shown that

> *PBL-education graduates and students leave university with better qualifications to tackle a wide range of new problems, across the traditional boundaries of disciplines. These students graduate with better qualifications in important work skills like cooperation, communication and management of the creative process. Against this background one would expect that the employers would welcome newly graduated PBL engineers - and this is indeed the case* [27].

CONCLUSIONS

Engineers are problem solvers. This is a statement with which very few educators would disagree. However, there is disagreement as to *how engineers are taught to be problem solvers?* [28]. Based on the evidence from over 30 years of experience in engineering programmes in Europe and North America, the answer to this question appears to be: *using a PBL-approach*.

PBL emphasises learning instead of teaching. Learning is not like pouring water into a glass; learning is an active process of investigation and creation based on learners' interest, curiosity and experiences, and should result in expanded insights, knowledge and skills [20][29].

Embarking on this path of curriculum revolution is not without its challenges. As stated by Glen O'Grady at the Republic Polytechnic:

> *It is not difficult to find educators who are sympathetic to the principles of PBL but what is challenging is having the will, capacity, opportunity, and knowledge of how to apply these principles to specific contexts. For those embarking on the path of implementing PBL, the way is often unmapped and the light is dim* [15].

Despite the easily imagined difficulties, all is not lost on the high seas. This does not mean that educators should not consider PBL. As the ancient proverb suggests, a journey of a thousand miles always begin with just one step. Total curriculum revolution does not happen overnight. As previously explored, PBL can be integrated within even one class using a wandering tutor model to explore an interesting problem. Taking that first step can start the exciting process towards curriculum innovation. Taking the initial risk will liberate educators from the riverbanks as they embark on a voyage of discovery with their students.

The need is present for change; the global and work environments demand it. Graduates from a PBL programme will be better suited to the changing nature of the workplace. As self-directed, life-long learners, these graduates will add value to the workplace by being adaptable to changes and being better able to help their companies compete in a global workplace.

REFERENCES

1. Woods, D.R., *Problem-Based Learning: How to Gain the Most from PBL.* Waterdown: Donald R. Woods Publisher (1994).
2. Rideout, E. and Carpio, B., *The Problem Based Learning Model of Nursing Education*. In: Rideout, E. (Ed.), Transforming Nursing Education through PBL. Boston: Jones and Bartlett Publishers (2001).
3. Manchester School of Engineering, Problem-Based Learning (2001), http://www.eng.man.ac.uk/engineering/pbl.htm
4. Woods, D., Problem-Based Learning, Especially in the Context of Large Classes, http://chemeng.mcmaster.ca/pbl/pbl.htm
5. Schmidt, H.G., Foundations of problem-based learning: some explanatory notes. *Medical Educ.*, 27, 422-432 (1993).
6. Harden, R., Grant, J., Buckley, G. and Hart, I., Best evidence medical education. *Medical Teacher*, 21, **6**, 553-562 (1999).
7. Kjersdam, F. and Enemark, S., Evaluation of the Aalborg Experiment (1994), http://www.auc.dk/fak-tekn/aalborg/engelsk/evaluation.htm
8. Albanese, M. and Mitchell, S., Problem-based learning: A review of the literature on its outcomes

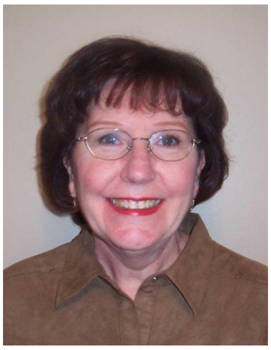
and implementation issues. *Academic Medicine*, 68, **1**, 52-81 (1993).
9. Albanese, M. and Xakellis, G.C., Building collegiality: the real value of problem-based learning. *Medical Educ.*, 35, 1143 (2001).
10. Andersen, H. Experiences from a pedagogical shift in engineering education. *Global J. of Engng. Educ.*, 6, **2**, 139-144 (2002).
11. Fortelius, C. and Akerman, M-L., A Problem-Based Learning (PBL) approach in environmental monitoring for young adult and mature engineering students. *Proc. 3rd Global Congress on Engng. Educ.*, Glasgow, Scotland, UK, 91-94 (2002).
12. McMaster University, Excellence in Course or Resources Designs, http://www.mcmaster.ca/learning/awards/crowe_and_woods.htm
13. Prpic, J.K. and Hadgraft, R.G., What is Problem-Based Learning? (1999), http://cleo.eng.monash.edu.au/teaching/learning/strategy/whatispbl.html
14. Temasek Engineering School, Problem-Based Learning, http://www-eng.tp.edu.sg/tpeng/cen/pbl.xml
15. O'Grady, G. (Ed.), Reflections on PBL (2002), http://www.rp.edu.sg/pbl/rpnewsletter_issue1.pdf
16. Samford University, Who is Doing Problem-Based Learning? (2002), http://www.samford.edu/pbl/search/whosearch.shtml
17. Sanoff, A.P., A quiet sort of revolutionary. *Prism*, 12, **1**, September, 26-30 (2002).
18. Moesby, E. From pupil to student – a challenge for universities: an example of a PBL study programme. *Global J. of Engng. Educ.*, 6, **2**, 145-152 (2002).
19. Dale, E., *Audio-Visual Methods in Teaching* (3rd edn). Austin: Holt, Rinehart and Winston (1977).
20. Enemark, S., Innovation in surveying education. *Global J. of Engng. Educ.*, 6, **2**, 153-159 (2002).
21. Boud, D. and Feletti, G., *The Challenge of Problem-based Learning*. New York: Kogan Page (1977).
22. Accreditation Board for Engineering and Technology (ABET), Engineering Criteria 2000 (3rd edn). December, Baltimore: ABET (1997).
23. Canadian Council of Professional Engineers (CCPE). 2001 Accreditation Criteria and Procedures. Ottawa: CCPE (2001).
24. Shooter, S. and McNeill, M., Interdisciplinary collaborative learning in mechatronics at Bucknell University. *J. of Engng. Educ.*, 91, **3**, 339-344 (2002).
25. Bridges, W., Job shifts in the new economy. *Training and Development Magazine*, April (1999).
26. Kjersdam, F. and Enemark, S., The Aalborg Experiment. Project Innovation in University Education. Aalborg: Aalborg University Press (1994).
27. Kjærsdam, F., Engineering education for the knowledge society. *Proc. 3rd Global Congress on Engng. Educ.*, Glasgow, Scotland, UK, 87-90 (2002).
28. Wood, D., Wright, J.D., Hoffman, T.W., Swartman, R.K. and Doig, I.E., Teaching program solving skills. *Engng. Educ.*, December, 238-243 (1975).
29. Kolmos, A., Reflections on project work and problem-based learning. *European J. of Engng. Educ.*, 21, **2**, 141-148 (1996).

BIOGRAPHIES

Melissa D. Northwood, RN, BScN, is a gerontological nurse who is employed as a Clinical Educator at St Peter's Hospital, a complex continuing care facility in Hamilton, Ontario, Canada. She is a graduate of a PBL curriculum, namely the Bachelor of Science in Nursing programme at McMaster University, also in Hamilton. She is presently working with her colleagues at St Peter's on a model of PBL for continuing education of nursing staff.

Derek O. Northwood is currently Professor of Engineering Materials in the Department of Mechanical, Automotive and Materials Engineering at the University of Windsor, Windsor, Ontario, Canada. Prior to rejoining the University of Windsor in November 2002, he served from 1997-2002 as Dean of Engineering and Applied Science at Ryerson University in Toronto, Ontario, Canada, where he implemented a massive programme of faculty renewal, enhanced the faculty's research profile, established the first graduate programmes in engineering, launched many initiatives in engineering education including the promotion of the *Women in Engineering* programme.

A materials engineer by training, Professor Northwood has published extensively with 229 papers in refereed international journals and 206 papers in refereed conference proceedings.



Marilyn G. Northwood has over 20 years of diverse management experience in human resources in both the public and private sectors, having worked in education, municipal government, automotive manufacturing and banking environments.

Currently, Marilyn is a Career Management Consultant with Right Axmith, which is part of the world-wide group of Right Management Consultants.

Her academic background includes a Bachelor of Arts degree and studies at the School of Business Administration at the University of Windsor, Windsor, Ontario, Canada. Marilyn has a Certified Human Resources Professional designation and is a member of the Human Resources Professionals Association of Ontario, Canada.