

Developing Generic Skills in Classroom Environment: Engineering Students' Perspective

M. Z. Kamsah

Centre for Teaching and Learning
Universiti Teknologi Malaysia
81310 UTMSkudai, Johor
Email: zaki@fkkksa.utm.my

Abstract: The two greatest concerns of employers today are finding good workers and training them. The difference between the skills needed on the job and those possessed by applicants, sometimes called the skills-gap, is of real concern to human resource managers and business owners looking to hire competent employees. While employers would prefer to hire people who are trained and ready to go to work, they are usually willing to provide the specialized, job-specific training necessary for those lacking such skills. Most discussions concerning today's workforce eventually turn to employability or generic skills. Finding workers who have generic or job readiness skills that help them fit into and remain in the work environment is a real problem. Universiti Teknologi Malaysia has launched its list of graduate attributes in the second quarter of 2004 in which the university believes will enable its graduates to function effectively in a wide range of social and professional contexts. A class of forty final year undergraduate chemical engineering students were asked to score their competencies on the seven attributes listed by the university and to give suggestions on ways of improving the skills required in the class room environment.

1.0 Introduction

Generic skills are "employability" skills used in the application of knowledge. These skills are not job specific, but are skills which cut horizontally across all industries and vertically across all jobs from entry level to chief executive officer. The degree to which students develop these skills determines how they solve problems, write reports, function in teams, self-assess and do performance reviews of others, go about learning new knowledge, and manage stress when they have to cope with change. Many lecturers intuitively believe that process skills are important, but most are unaware of the fundamental research that provides a foundation for development of the skills. Their efforts to help their students develop the skills may consequently be less effective than they might wish [1].

Fostering the development of skills in students is challenging, to say the least. Generic skills – which have to do with attitudes and values as much as knowledge – are particularly challenging in that they are hard to define explicitly, let alone to develop and

assess. We might be able to sense that a team is not working well, for example, but how do we make that intuitive judgment quantitative? How might we provide feedback that is helpful to the team members? How can we develop our students' confidence in their teamwork skills?

Research suggests that the development of *any* skill is best facilitated by giving students practice and not by simply talking about or demonstrating what to do [2]. The lecturer's role is primarily that of a coach, encouraging the students to achieve the target attitudes and skills and providing constructive feedback on their efforts. A number of approaches to generic skill development have been formulated and proven to be effective in science and engineering education, including Guided Design [3], active/cooperative learning approaches [4][5], Thinking-Aloud Pairs Problem Solving (TAPPS), and the McMaster Problem Solving program [2].

2.0 Developing Generic Skills

Today's engineering graduates are not lacking in technical competency or in their understanding of science, math, and physics. These graduates lack competency in the generic skills that enable them to use their technical skills most effectively.

Generic skills enable them to use their technical abilities as a part of a team, to understand conflict as a means for discussion instead of an angry confrontation, and to respect difference as a creative opportunity rather than an obstacle. To achieve success, today's engineers must be team members who thrive while working with a variety of people having differing social, educational, and technical skills

Discussions of the need for educational reform and restructuring typically include concern about the gap between the skill requirements for entry-level employment and the skill levels of entry-level job applicants [6][7][8].

Graduates lacking of generic skills is a global issue. Employers worldwide found far too many entry-level job applicants deficient in generic skills, and want the public schools or institutions of higher learning to place more emphasis on developing these skills [9][10][11][12][13][14][15][16].

Valuing generic skills to the point of assigning them an even higher priority than job-specific

technical skills-employers are understandably distressed to find so many entry-level job applicants lacking these skills. Charner [11] identified and catalogued the reasons given by employers for not hiring young people for entry-level jobs, including:

- *Low grades and low levels of academic accomplishments*
- *Poor attitudes, lack of self-confidence*
- *Lack of goals, poorly motivated*
- *Lack of enthusiasm, lack of drive, little evidence of leadership potential*
- *Lack of preparation for the interview*
- *Excessive interest in security and benefits, unrealistic salary demands and expectations*
- *Inadequate preparation for type of work, inappropriate background*
- *Lack of extracurricular activities*
- *Inadequate basic skills (reading, writing, math) (p. 30).*

Employers' dissatisfaction with young job applicants is not primarily due to inadequate technical knowledge or skill. Wentling's observation is typical:

.... A review of the literature indicated that employers have no quarrel with the skills performance of today's graduates, but they do have serious reservations when it comes to their non-technical abilities [17].

Researches have shown that generic skills are best learned when they are included among instructional goals and explicitly taught [18][19][20][21]. This assertion may seem obvious. However, there continue to be many engineering and non-engineering lecturers and administrators who believe that students will pick up these skills and abilities incidentally in the course of growing up and being in the public schools and institutions of higher learning. The research conducted with employers and reported above makes it clear that this is not the case.

Others believe that some capabilities-particularly critical and creative thinking and affective traits such as a positive attitude and a cooperative manner are qualities that people either have or don't have. In other words, they do not see these qualities as teachable. Research, however, shows that these generic skills and traits are very amenable to being taught [19][20][21][22][23][24][25].

3.0 UTM's Graduate Attributes

There is a need emerging for science and technically trained professionals who possess more skills than offered by a single discipline. However, the skills currently being integrated are often either two sciences (such as biochemistry), science and business, engineering and science, engineering and business or special MBA programs for persons having mathematics, engineering, or science degrees. These

programs continue to further expand knowledge based on problem solving rather than providing the complementary skills needed to use problem solving ability.

UTM has identified a range of attributes and generic skills which will enable its graduates to function effectively in a wide range of social and professional contexts. The development of these attributes will be embedded within the contexts of the students' discipline or professional field. The seven attributes were launched in June 2004 and are listed below:

1. Communication Skills (CS)
2. Teamworking (TW)
3. Problem Solving (PS)
4. Adaptability (AD)
5. Lifelong Learning (LL)
6. Self-Esteem (SE)
7. Ethics and Integrity (ET)

The university envisaged that every single graduate of the university should possess the seven attributes so that they could function effectively in the society and at the workplace. Efforts have been carried out to embed the skills training in the curriculum. Several workshops were conducted where selected lecturers from each faculty were trained in developing the skills among their students in the classrooms. Curriculum and syllabus were revamped by using an infusion approach where the desired skills are addressed in the existing technical as well as non-technical subjects.

4.0 Students' Perspective

A class of forty final year chemical engineering students in semester I session 2004/05 were asked to rank their confidence and ability on the seven UTM's graduate attributes based on a Lickert scale of 1 – 10 (1 = no confidence; 10 = very confidence). They were enrolled in a Plant Design course where the mode of learning used by the lecturer was the cooperative learning. The students were in the ninth semester of their 10-semester undergraduate programme and the mean score of the whole class is shown in Figure 1.

Students ranked their confidence quite high on teamworking, problem solving, adaptability, and communication skills. They claimed these were due to the cooperative learning environment that they were exposed to in the Process Control (which was taken in semester eight) and Plant Design classes.

Other attributes such as lifelong learning, self esteem and ethics scored quite moderate and these were due to no or less emphasis was given to develop these skills in their classrooms. Many argued that many lecturers were delivering knowledge or materials confine to the subject matters where their main references were either the lecturers' notes or the

textbooks. There were also no or very minimal usage of references from journals or other reading materials. Interactions with their successful alumni and students from other university were nearly non-existence with the exception of a few who were involved in the Students Representative Council or the annual Inter-Varsity Sports Competition.

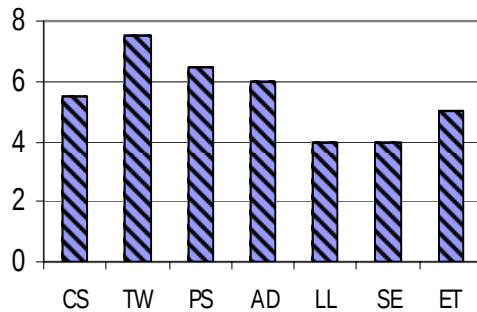


Fig. 1. Mean Score of Confidence Level on Generic Skills

Few suggestions were given by the students on ways of improving their generic skills in the classrooms. They were looking forward for more group discussions, public speaking and presentation in order to improve their communication skills. They strongly recommended cooperative learning environment for teamwork development and even suggested some assessments - such as quizzes - given on a group basis. However, skills on team management still need to be improved.

Active and cooperative learning have contributed a lot on their confidence levels on problem solving skills. Generating and contributing ideas were part and parcel of these activities and hence, they were quite happy to have more subjects to be conducted in this manner. However, they highlighted these activities should be conducted by trained lecturers so that they would be properly guided and facilitated.

As for the adaptability skills, they needed more exposure of real industrial life, some opportunities for part time jobs on campus and more activities that blend people from different culture. A change of reading habits, sharing experiences and moments of their life, and be involve in more research activities were the suggestions for lifelong learning. They also highlighted only a few reading materials available at the faculty's resource centre.

Suggestions of showcasing successful UTM's alumni were brought up in order to boost their self esteem. They believed interactions with successful alumni could certainly bring more self worth as UTM's graduates. Motivation camps, intervarsity non-sports competitions, personality test and changing the students' card to smart card type were the other suggestions of improving their self esteem.

The group believed that ethics are quite a sensitive issue since it involves moral and religious values.

However, they very much welcome activities – co curricular and social – that involve people from different race or religion. They strongly recommended strict rules and discipline being enforced in laboratories and certain restricted areas.

5.0 Effective Classroom Strategies

Many researches have been carried to study the effectiveness of different approaches to teaching generic skills. Some of the findings are reported below:

5.1 Democratic instructional approaches are superior to indoctrinational approaches for imparting generic skills to students and workers. [12][20][21][26][27]

One line of inquiry in the generic skills research compares "indoctrinational" and "democratic" instruction in terms of their effectiveness in developing students' work values and attitudes. Democratic approaches are said to:

...raise student consciousness about values, attitudes, and worker responsibilities.... pedagogical strategies such as role playing/simulation, problem solving, and group discussion are democratic in nature because they encourage students to explore their attitudes and do not advocate one particular outcome [12].

Indoctrinational instruction, meanwhile, is described as:

...a process by which students are given information in such a manner that they are discouraged or prevented from questioning its validity [and] includes pedagogical strategies that minimize student input [12].

Lectures and the use of reward structures are among the strategies considered to be indoctrinational. Comparison of teachers who are successful in inculcating affective generic skills in their students with those who are less successful or unsuccessful reveals that the successful teachers rely much more on democratic strategies and much less on indoctrinational ones. Hence, active and cooperative learning modes are most conducive for developing the generic skills [5][25].

5.2 A key feature of classes that successfully teach generic skills is that instructors hold and communicate high expectations for the learning and behaviour of their students-whether or not the overall culture of the school holds high expectations for them. [18][20][21][28]

The general educational research shows that holding and communicating high expectations for students' learning and deportment are critical features of effective schooling. Unfortunately, in some secondary school settings, vocational classes are treated as low-ability tracks and/or repositories for

troublesome students. Since research also shows that low expectations are frequently communicated to students in lower tracks, students in vocational programs are oftentimes given negative messages about their capacity to learn and conduct themselves appropriately.

Chickering and Gamson [28] stressed high expectation as one of the good principles in undergraduate teaching. Lecturers should expect more and they will get it. High expectations are important for everyone – for the poorly prepared, for those unwilling to exert themselves, and for the bright and well motivated. Expecting students to perform well becomes a self-fulfilling prophecy when teachers and institutions hold high expectations of themselves and make extra efforts.

5.3 In classes that effectively teach generic skills, instructors assume the role of facilitators and coaches rather than lecturers and order givers, requiring students to take much of the responsibility for their own learning. [20][21][25]

"All students," write Stasz, et al., "need to acquire not only knowledge and skills but also a positive perspective on learning that includes their own responsibility for it" [21]

In another kind of learning activity, students may be given certain situational factors which might be present in a workplace setting, and then, with input and guidance from the instructor, engage in role-playing to resolve the situation or make recommendations regarding it.

Woods et al. [25] suggested that the development of any skill is best facilitated by giving students practice and not simply talking about or demonstrating what to do. The instructor's role is primarily that of a coach, encouraging the students to achieve the target attitudes and skills and providing constructive feedback on their efforts.

5.4 An effective learning environment for generic skills development has to be created and well planned. [5][25]

Woods et al. [25] suggested eight basic activities that could be carried out in any classroom which were based on research findings:

- a. *Identify the skills you wish your students to develop, include them in the course syllabus and the university catalog, and communicate their importance to the students.* Be sure the students understand the relevance of the skills to their professional success, and discuss the skills with the same level of seriousness and enthusiasm that you use when presenting the technical content of the course.
- b. *Use research, not personal intuition, to identify the target skills, and share the research with the students.*

- c. *Make explicit the implicit behaviour associated with successful application of the skills.* Much processing takes place subconsciously in the head of a skilled practitioner. When asked "How do you do that?" she replies "I don't know; it just happens." Our task is to take the skill and behaviour apart, discover what really is important (based on research), and communicate it to the students in easily digestible chunks.

- d. *Provide extensive practice in the application of the skills, using carefully structured activities, and provide prompt constructive feedback on the students' efforts using evidence based targets.* People acquire skills most effectively through practice and feedback. No matter how many times students see a skill demonstrated, they rarely master it until they have attempted it repeatedly and received guidance in how to improve their performance after each attempt.

- e. *Encourage monitoring.* Monitoring is the metacognitive process of keeping track of, regulating, and controlling a mental process, considering past, present and planned mental actions. As students are working, ask them to pause periodically and write responses to questions that force them to deepen their problem-solving approach and improve their understanding.

- f. *Encourage reflection.* Reflection is the metacognitive process of thinking about past actions. For each problem that the students solve, communication they write, or team task they accomplish, ask them periodically to write reflections on how they approached the task.

- g. *Grade the process, not just the product.* For some assignments grade *only* the problem solving process, the team process, or the prewriting process. Grade the reflections, using the target skills.

- h. *Use a standard assessment and feedback form.* Departmental instructors should decide on criteria, and the same assessment and feedback forms should be used across the curriculum.

6. Conclusions

Delivering lecture is the easiest part of teaching; far more challenging is the task of equipping students with the generic skills they will need to succeed as professionals and responsible members of society.

Having been exposed to active and cooperative learning styles students ranked themselves quite high in communication, teamwork and problem solving and quite moderate on other attributes. Students were found to be greatly excited with the opportunities of giving presentations and public speaking in the class.

Preparing classroom for generic skills development certainly requires proper planning and preparation. Giving a full lecture or demonstrating the skills are not proven methods of developing the skills among the students.

References

- [1] Donald R. Woods, Richard M. Felder, Armando Rugarcia, James E. Stice, The Future Of Engineering Education III. Developing Critical Skills, *Chem. Engr. Education*, 34(2), 108–117 (2000).
- [2] D.R. Woods, A.N. Hrymak, R.R. Marshall, P.E. Wood, C.M. Crowe, T.W. Hoffman, J.D. Wright, P.A. Taylor, K.A. Woodhouse, and C.G.K. Bouchard, "Developing Problem-Solving Skills: The McMaster Problem Solving Program." *J. Engr. Education*, 86(2), 75–91 (1997).
- [3] D.R. Woods, *Problem-Based Learning: Resources to Gain the Most from PBL*. Woods, Waterdown, ON, distributed by McMaster University Bookstore, Hamilton ON, 1997. Available on-line at <http://chemeng.mcmaster.ca/innov1.htm> >.
- [4] R.M. Felder and R. Brent, *Cooperative Learning in Technical Courses: Procedures, Pitfalls and Payoffs*. ERIC Document Reproduction Service, ED 377038 (1994). <http://www2.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Coopreport.html>
- [5] R.M. Felder, D.R. Woods, J.E. Stice, and A. Rugarcia, "The Future of Engineering Education. II. Teaching Methods that Work." *Chem. Engr. Education*, 34(1), pp 26–39 (2000).
- [6] **Berita Harian**, *Kursus IPTA dikaji semula*, 17th May 2004
- [7] The Star, *Life skills matter more*, 3rd Feb. 2004.
- [8] The Star, *What a multinational recruiter looks for*, 1st Feb. 2004
- [9] Baxter, M. B., and Young, J. L. "What Do Employers Expect From High School Graduates?" *NASSP Bulletin* 66/458 (1982): 93-98.
- [10] Cotton, K., *Developing Employability Skills, School Improvement Research Series*, www.....
- [11] Charner, I., "Employability Credentials: A Key to Successful Youth Transition to Work." *Journal of Career Development* 15/1 (1988): 30-40.
- [12] Gregson, J. A., "Effective Pedagogical Strategies for Work Attitudes Instruction." *Journal of Industrial Teacher Education* 29/3 (1992): 60-79.
- [13] Packer, A. H., "Taking Action on the SCANS Report." *Educational Leadership* 49/6 (1992): 27-31.
- [14] Painter, C. M., "A Survey of Communications Skills Needed On-the-Job by Technical Students." *Journal of Studies in Technical Careers* 7/3 (1985): 153-160.
- [15] Poole, V. A., "Work Experience Programs Can Help Develop Human Relations Skills." *Business Education Forum* 39 (1985): 9-10.
- [16] Wentling, R. M., "Employability Skills: The Role of Business Education." *Journal of Education for Business* 62/7 (1987): 313-317.
- [17] Wentling, R. M., "Teaching Employability Skills in Vocational Education." *Journal of Studies in Technical Careers* 9/4 (1987): 351-360.
- [18] Lankard, B. A., *Employability - The Fifth Basic Skill*. ERIC Digest No. 104. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education, 1990. (ED 325 659)
- [19] Meyer, E. C., and Newman, D., "Effects of a Commercial Self-Improvement Program on the Work Adjustment Skills of Cooperative Marketing Education Students." *Journal of Vocational Education Research* 13/2 (1988): 35-51.
- [20] Stasz, C.; McArthur, D.; Lewis, M.; and Ramsey, K., *Teaching and Learning Generic Skill for the Workplace*. Santa Monica, CA: RAND, 1990.
- [21] Stasz, C.; Ramsey, K.; Eden, R.; DaVanzo, J.; Farris, H.; and Lewis, M., *Classrooms that Work: Teaching Generic Skills in Academic and Vocational Settings*. Santa Monica, CA: RAND, 1993.
- [22] Buck, L. L., and Barrick, R. K., "They're Trained, But Are They Employable?" *Vocational Education Journal* 62/5 (1987): 29-31.
- [23] Foster, D. E.; Engels, D. W.; and Wilson, M. J., "Knowledge Acquired in a Program for Building Employability Skills." *Journal of Employment Counseling* 23/4 (1986): 176-177.
- [24] Greathouse, L., "More Than Technical Skills Needed for Career Success." *Business Education Forum* 41/2 (1986): 9-11.
- [25] Woods, Donald R., Richard M. Felder, A. Rugarcia, James E. Stice, The Future Of Engineering Education III. Developing Critical Skills, *Chem. Engr. Education*, 34(2), 108–117 (2000).

- [26] D.W. Johnson, R.T. Johnson, and K.A. Smith, *Active Learning: Cooperation in the College Classroom*, 2nd edn. Interaction Book Co., Edina, MN, 1999.
- [27] R.M. Felder, G.N. Felder, and E.J. Dietz, "A Longitudinal Study of Engineering Student Performance and Retention. V: Comparisons with Traditionally-Taught Students," *J. Engr. Education*, 87(4), 469–480 (1998).
- [28] Chickering, A.W., and Gamson, Z.F. (1991). *Applying the Seven Principles for Good Practice in Undergraduate Education*. New Directions for Teaching and Learning. Number 47, Fall 1991. San Francisco: Jossey-Bass Inc.