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# Students' perspective on the attainment of graduate attributes through a design project

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ABSTRACT: Employers are demanding graduates who are competent in specific discipline knowledge and have the generic skills to cope with the ever-changing work environment. In response to this challenge, there is a growing trend in higher education with regard to the integration of graduate attributes in undergraduate programmes. Graduates must be able to solve problems, communicate effectively, work in teams and think creatively, and possess sound information technology skills. Integration of these skills in the curriculum demands a new approach to learning, teaching and assessment methods. This article presents a case study that was conducted at the University of Botswana with industrial design students to determine the effectiveness of a major design project in delivering graduate attributes. The study confirmed that project-based learning was an effective teaching approach in attaining graduate attributes. The study also revealed that students seemed to have attained most of the graduate attributes, such as creative thinking skills, accountability and ethical standards, and critical thinking skills.

Keywords: Case study, graduate attributes, project-based learning, industrial design, design project

## INTRODUCTION

Graduate attributes are important factors in planning the curriculum of any university undergraduate programme. The attributes demanded by industry are twofold: technical knowledge and skills, and generic attributes. Generic attributes cover soft skills, personal attributes and values, which graduates should acquire irrespective of their area of study. Some studies have revealed that there is a mismatch between the skills students develop during their studies and the skills that employers need [1]. Graduate attributes have now become one of the core sets of higher education outcomes that every graduate should possess [2]. Integration of generic attributes in the curriculum ensures that students develop skills that will better equip them for the work environment and self-employment. Higher learning institutions put an increasing value on developing graduate attributes, seeking to renew and articulate their purpose in response to calls for accountability and quality assurance processes. Yorke argues that there is a correlation between graduate attributes and quality assurance measures because they are both used to compare and measure university academic programmes and their effectiveness [3]. Graduate attributes are:

> *The qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future* [4].

Many universities have redefined their curriculum to incorporate graduate attributes in teaching programmes and students with appropriate graduate skills demand a new approach to teaching and learning, which promotes integration and flexibility in working in multi-disciplinary projects [5]. This article presents a case study developed to assess the attainment of graduate attributes in fifth year industrial design students at the University of Botswana.

The industrial design programme at the University of Botswana has adopted a project-based learning approach to address the rapidly changing workplace and societal environments. The literature shows that project-based learning approach provides graduates with conventional technical knowledge, as well as with suitable generic skills [6-8].

## GRADUATE ATTRIBUTES IN THE CURRICULUM

When developing a curriculum, traditionally, more emphasis is placed on technical skills, which cover discipline knowledge and skills. Of late, the emphasis also includes the development of generic attributes, called transferable

skills. Candy argues that whereas disciplinary knowledge is transient, generic skills such as communication, teamwork, leadership and analytic and critical thinking should be the hallmark of any graduate irrespective of the field of study [6]. Therefore, the opportunity to broaden students' knowledge and develop generic attributes is an important element in the curriculum. The development of those attributes can be effectively achieved in disciplinary contexts, as an integral part of the curriculum, and not just stacked on as an afterthought [9-10].

These skills are often embedded and integrated within different courses offered by an institution. Some authors observe that it is only through the study of a body of knowledge that generic skills, attributes and values can be acquired [11]. Lowe and Marshall [12] and Crosthwaite et al [7] argue that the development of the broader spectrum of graduate attributes is more likely when students are engaged with realistic and relevant experiences that demand the integration and practice of these skills in contexts that students find meaningful. Bath et al further state that the importance of generic attributes in higher education has been influenced by three factors:

1. the popular perspective that education is a lifelong process;
2. a greater focus on the relationship between education and the employment of graduates; and
3. the development of outcome measures as part of the quality assurance [9].

Bath et al report that it is difficult to show evidence of the achievement of some graduate attributes [9]. This has become an important issue, particularly, in the quality assurance and accountability platforms and processes. Institutions are increasingly required to show evidence of the achievement of their objectives, including those related to generic learning outcomes. Equipping students with necessary generic skills is much harder than determining whether or not they have these skills [5].

While some lecturers may not perceive the development of graduate attributes as part of their teaching obligation, it is indeed the educational responsibility of the university. Despite this dichotomy, without doubt the integration of generic attributes into the curriculum has significant benefits for the academic institutions and their stakeholders (government, industry and accreditation bodies). Some of the benefits include:

a) Employers expect their potential employees to be able to function efficiently in an ever-changing work environment. Graduates must be able to solve problems, communicate effectively with clients and colleagues, work in teams, think creatively, and critically and have sound information technology skills.
b) Through the adoption of graduate attributes, the universities are better placed to meet stakeholders' interests in producing a more competent workforce - professionals with a broad range of capabilities in addition to discipline related expertise [8][10]. Therefore, it is no longer sufficient for graduates simply to acquire specific discipline knowledge to guarantee them employment at the completion of their studies.
c) Nowadays, knowledge becomes obsolete quickly. In order for graduates to remain employable they must be flexible and adaptable to the ever changing work environment. They need to become lifelong learners, open to new ideas and new ways of learning, thinking and delivering tasks.

The identification of graduate attributes, both technical and generic, within a programme is depicted in the planning, implementation and evaluation of the curriculum. Curriculum design, teaching and learning strategies, and assessment activities reflect a commitment to supporting students to achieve generic skills and capabilities as well as discipline related knowledge and skills.

However, Carew et al caution that it is a challenge to modify the curriculum to enhance graduate attributes, while continuing to maintain technical competence at a high level and within limited programme time [13]. Various researchers have identified a range of challenges in teaching and assessment of graduate attributes, such as lack of time by academics, motivation, resources or skills to modify teaching and assessment approaches, confusion over the definitions of graduate attributes and the appropriate balance between technical learning and skills development.

Table 1: Employers rating of graduate attributes.

| Graduate attribute | Weighted average rating |
|---|---|
| Ability to work in a team structure | 4.60 |
| Ability to verbally communicate with persons inside and outside the organisation | 4.59 |
| Ability to make decisions and solve problems | 4.49 |
| Ability to obtain and process information | 4.46 |
| Ability to plan, organise and prioritise work | 4.45 |
| Ability to analyse quantitative data | 4.23 |
| Technical knowledge related to the job | 4.23 |
| Proficiency with computer software programmes | 4.04 |
| Ability to create and/or edit written report | 3.65 |
| Ability to sell or influence others | 3.51 |

A recent study conducted by the National Association of Colleges and Employers projected the skills that will be needed by employers in 2012 [1]. The survey involved 244 organisations that hire new graduates from institutions of higher learning. Employers rated the skills on a 5-point Likert scale, where 1 = not important; 2 = not very important; 3 = somewhat important; 4 = important and 5 = extremely important. Table 1 shows the top ten skills which employers will be looking for in new graduates [1].

Table 1 illustrates that employers rated the following attributes as the top three they will be looking for in new graduates: ability to work in a team structure; ability to communicate verbally with persons inside and outside the organisation; and the ability to make decisions and solve problems. The two least important attributes were considered to be the ability to create and/or edit written reports and the ability to sell or influence others.

## UNIVERSITY OF BOTSWANA GRADUATE ATTRIBUTES

The University of Botswana has identified a number of graduate attributes which are relevant to students, employers, and other stakeholders [14]. These attributes include the following: Information and communication technology knowledge and skills; Self-directed, lifelong learning skills; Critical and creative thinking skills; Problem-solving skills; Communication skills; Entrepreneurship and employability skills; Organisational and teamwork skills; Research skills; Social responsibility and leadership skills; Interpersonal skills; Cross-cultural fluency; and Accountability and ethical standards. The industrial design programme has added environment and sustainability because users are environmentally conscious and they may not buy products that are not environmentally friendly or unsustainable.

## INDUSTRIAL DESIGN PROGRAMME AT THE UNIVERSITY OF BOTSWANA

The structure of the programme has a science base at first year level. In the second year, students take a common curriculum with engineering students, as well as being introduced to a few design courses. From the third to fifth years, students focus on core design courses. The industrial design programme has been planned in such a way that as students progress through the programme, the complexity of projects increases to emphasise technical challenge and creativity, and develop real professional design practice. Crosthwaite et al recommend the inclusion of a spine of project work that should span the entire programme, and it should be supported by, and integrated with, all core teaching and learning activities [7].

## PROJECT-BASED LEARNING APPROACH

The traditional lecture-centred approach is common in delivering design education and it seems to produce graduates with acceptable technical knowledge. However, if design education is to improve the development of graduate attributes, the learning and teaching approaches have to be changed. The evidence from literature suggests that the Project-Based Learning (PBL) can be used as the key mechanism for students to develop and reflect on their individual skills [15].

Project-based learning is one of the learner-centred approaches, which enable students to connect knowledge, skills, values and attitudes and construct knowledge through a variety of learning experiences [16-17]. Therefore, PBL provides the contextual environment that makes learning exciting and relevant. The PBL model is an example of a constructivist learning theory which states that:

> *Knowledge can be constructed personally, through reflection and relating new knowledge to prior experiences, or socially, through interaction and discussion with others, such as teachers, other learners or family and friends. Either way, knowledge becomes personal and embedded within a context that is relevant to learner's own life and experiences* [18].

Introducing projects into the curriculum is not a new idea in education. The practice has evolved into a more formally defined teaching strategy. PBL is an educational model that organises learning around doing projects. PBL is a systematic teaching method that engages students in learning essential knowledge and life-enhancing skills through an extended, learner-influenced inquiry process structured around complex, authentic questions and carefully designed products and tasks [17].

Projects are tasks based on challenging questions or problems, decision making or investigative activities, which give students the opportunity to work relatively independently or in teams over extended periods of time, and result in realistic products or presentations. This approach engages students in real-world activities and problems that have significance beyond the classroom.

The benefits of the PBL model to both students and lecturers include the following:

- stimulates students' interest and encourages active inquiry and higher-level thinking, problem-solving, collaborating, communicating, teamwork, independent working, critical thinking and self-directed lifelong learning [15-16];

- accommodates diverse learners with varying learning styles and differences by introducing a wider range of learning opportunities into the classroom;
- engages students as builders of a new knowledge base;
- integrates diverse curriculum areas, as well as linking students with real world problems and tasks.

In case of the Industrial Design programme, projects can be used to encode content and skills development from other concurrent and previous courses. PBL establishes a unifying teaching and learning framework across discrete courses and enables articulation that was previously not evident to students. Crosthwaite et al also suggested that projects are designed to be substantial pieces of the original work that simulate real design practice using topical tasks and problems sourced from industry [7]. Hence, the PBL approach provides a structured sequence of professional practice simulations as a vehicle for systematic and simultaneous development of graduate attributes, both technical and generic, and it stimulates discovery, learning and knowledge.

## METHOD

A case study was conducted with 38 students in the University of Botswana's Bachelor of Design (Industrial Design) programme. The purpose of the study was to find and analyse how the students perceive the attainment of graduate attributes through the final (year 5) major design project. A case study approach was chosen as the mode of empirical inquiry because it investigated a contemporary phenomenon within its real-life context. The boundaries between phenomenon and context were not clearly evident and multiple sources of evidence were used [19]. Creswell argues that in a case study the researcher seeks to develop an in-depth understanding of the case through collecting multiple forms of data [20].

In the major design project, students are given an open-ended design brief and they have to identify a problem in society and solve it. The whole process of identifying and solving the problem is considered to be an integral part of the fulfilment of the programme. The project is divided into two components to be delivered in two semesters. In the first semester, students conduct the necessary research and design work, whereas in the second semester students make prototypes that will solve the identified problem.

When undertaking the design project, students record all the design activities in a portfolio. The use of a portfolio involves documentation of examples of the attainment of skills, and self-reflection regarding those skills. This should assist students in the process of development of graduate attributes [8]. At the end of the design project, a questionnaire was administered to the students involved in this case study, based on a five-point Likert scale. The students rated their perceived level of attainment of the 15 prescribed graduate attributes.

A score of 1 represented (poor) attainment, 2 (satisfactory), 3 (good), 4 (very good) and 5 (excellent). In the open-ended questions, students reflected on what they liked about the project, explained why they rated some graduate attributes 2 or below, and 4 and above and outlined what aspects could be improved in future design projects.

## RESULTS AND DISCUSSION

The main aim of the study was to evaluate the students' perceived attainment of graduate attributes after undertaking the major design project. Figure 1 shows that few students rated the attainment of the graduate attributes as poor (2%), and (12%) rated them as satisfactory, (26%) as good, (37%) as very good and (23%) as excellently attained. In total, 86% of the students rated the attainment of graduate attributes as good or higher.

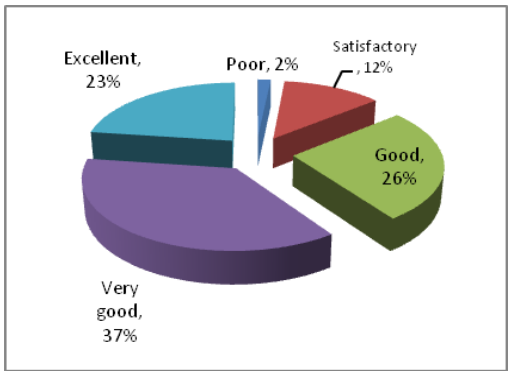


Figure 1: Perceived attainment of graduate attributes.

Overall, Figure 2 shows that a few attributes were rated as poor, for example, entrepreneurship skills (8%) and accountability and ethical standards (8%). Figure 2 also indicates that the following attributes were rated good: ICT knowledge and skills (47%), organisational and teamwork skills (39%) and social responsibility (32%).

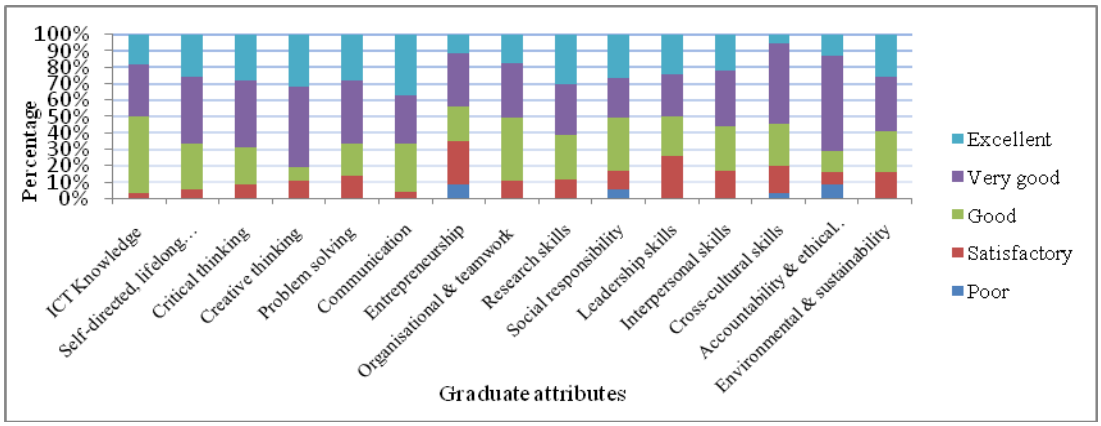


Figure 2: Rating of graduate attributes.

Figure 3 shows the graduate attributes rated at very good or higher. It can be observed that the ratings exceeded 50%.

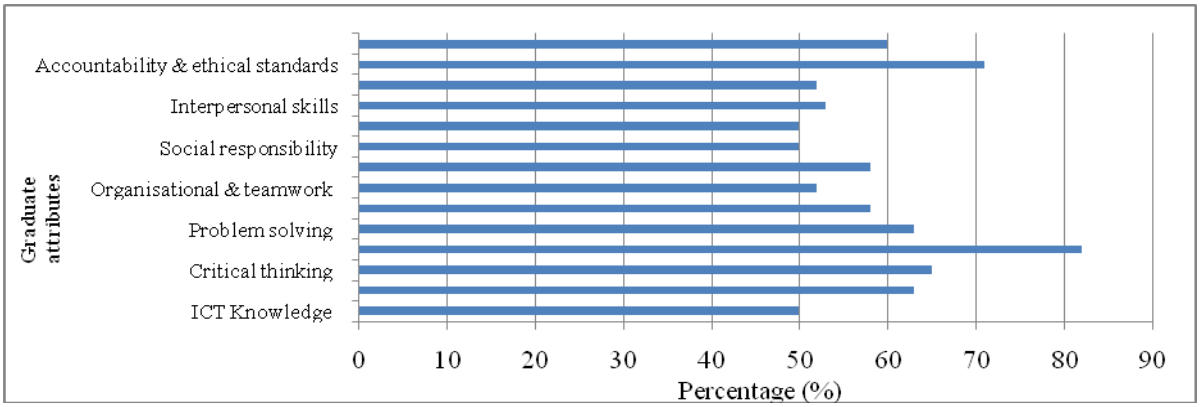


Figure 3: Graduate attributes rated very good and excellent.

The ratings indicate that the major design project assisted the students to attain most of the graduate attributes. Most attributes were rated to be very good and excellently attained by 50% or more students (Figure 3). For example, the students rated creative thinking skills (82%), accountability and ethical standard (71%) and critical thinking skills (65%) as the top three attributes they have acquired. These attributes, then, become the core skills developed and attained by the students when undertaking the major design project.

In the open-ended section of the questionnaire, the students were asked to reflect on what they liked about the project. Their responses centred on acquiring the following skills as key attributes: creativity and innovation, and communication. Several respondents stated the following with regard to creativity and innovation:

*The project tested my problem-solving and innovation skills.*
*From the presented projects, there was a lot of originality and innovation displayed...*
*I learnt a lot on creativity and innovation...*

The project also enabled the students to acquire communication skills. This was achieved through interacting with the different stakeholders they were working with. Some students mentioned that:

*The project enabled me to communicate effectively with the communities...*
*It has opened up my mind as to how to work with clients.*
*I learnt to interact with all stakeholders in solving a particular problem.*

Entrepreneurship skills and leadership skills were the least rated attributes by the students (Figure 2). They did not elaborate on why leadership was rated low in their reflections. However, it may be due to the fact that they did not work in structured teams where their leadership skills would have been challenged or developed. The following responses indicate that the major design project needs to be linked to a course in entrepreneurship:

*I wanted to learn more about entrepreneurship skills...*
*Entrepreneurship skills are not emphasised...*
*...offer a course on entrepreneurship skills prior to the major design project...*

The improvements, which the students would like to be made to the major design project include:

*Teach entrepreneurship skills at year 3 or 4 of the programme.*
*Assist students to attain cross-cultural skills when delivering on the project.*
*Some students need to improve their project presentation skills.*

Most students were satisfied that the graduate attributes prescribed to them were sufficient. However, a few responses mentioned that time management skills should be added to existing list of graduate attributes.

## CONCLUSIONS

Integration of generic attributes into the curriculum is currently considered to be the major theme in tertiary education worldwide. The importance of generic graduate attributes is compounded by the complexity of most modern workplaces, and even more importantly and challengingly, by the fact that the world of work is constantly changing [6]. Therefore, university education has to respond to demands from the employers in two ways: one with respect to the technical knowledge and skills and the second, equally important, the set of pre-defined generic attributes and skills.

The study aimed to find out the views of students in attaining graduate attributes through a major design project. The survey was administered on the cohort of industrial design students at the University of Botswana. The results show that the students are satisfied with how the project work conducted through the PBL assisted them in attaining graduate attributes. About 86% of the surveyed students indicated that they believe that they successfully attained the prescribed generic graduate attributes. However, the results presented show only the assessment based on students' opinions and they do not include both lecturers and employers' points of view. Tracer studies will need to be conducted to compare students' views on the subject area against those of the employers and lecturers. However, it can be argued that the personal attitude of students is the first step in having significant confidence to enter the world of work.

The societal, industrial changes and demands dictate that the universities have to adapt their teaching-learning methodologies continually to be relevant, appropriate and effective in addressing the integration and attainment of graduate attributes. Therefore, it is the responsibility of these institutions to develop and design modern curricula and course outlines that build students' knowledge and skills in a cohesive framework. This necessitates a shift from teacher-centred to learner-centred teaching methodologies.

The PBL approach is flexible and enables integration of many graduate attributes within a project. Such a learning approach ensures a commitment to quality; a focus on learning outcomes and a continued pursuit of relevance. Engaging students in real-life projects effectively aligns educational delivery with the professional practice. Students have the chance to simulate the required generic skills and work with different stakeholders, such as real clients and end-users of products and services.

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