

Using a Design-orientated Project to Attain Graduate Attributes

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Abstract

Nowadays universities are required not only to impart knowledge of specific disciplines but also generic graduate attributes such as communication, problem-solving, teamwork, creative thinking, research and inquiry skills. For students to attain these generic skills, educators are encouraged to use learner-centred approaches in teaching. Project-based learning is one such an approach which promotes self-directed and lifelong learning capabilities, equips students with transferrable knowledge and skills that are essential to the work environment, intertwines theory and practice, gives students the opportunity to gain a deep understanding of concepts and potentially allows them to solve the society's problems. A case study was conducted at the University of Botswana with Design students to assess the attainment of the graduate attributes after designing packages for a small entrepreneur producing frozen vegetables. The results indicate that the following graduate skills were either rated very good or excellent: self-directed, lifelong learning, critical and creative thinking, problem-solving, organisational and teamwork, communication, entrepreneurship, information and communication technology knowledge and skills. This shows that project-based learning can impart the skills and knowledge that the labour market needs. The results also provide an opportunity for educators to critically reflect on the type of projects given to students in relation to the attainment of graduate attributes.

Key words

attainment, design, graduate attributes, project-based learning, University of Botswana

Introduction

Graduate attributes or generic skills have received some attention in higher education in the past decade because it was realised that there is a mismatch between the skills students develop during their studies and the skills that employers need (*Job Outlook 2012 report*, 2011). Furthermore, universities have attempted to articulate the generic outcomes of the educational experiences they provide beyond the content knowledge that is taught. These attributes have become the core outcomes of higher education of which every graduate should possess (Barrie, 2006). This ensures that students develop attributes that will better equip them for the world of work as responsible members of the society. Higher learning institutions seek to renew and articulate their purpose and demonstrate the efficient achievement to generate attributes in response to calls of accountability and quality assurance processes.

There is a correlation between graduate attributes and quality assurance measures because they are the touchstone against which the university academic programmes are compared and against which, the university's effectiveness can be measured (Yorke, 2006). 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 (Bowden et al., 2000).

Graduate attributes are the skills and knowledge that all labour market participants should possess to ensure that they have the capability of being effective in the workplace – to the benefit of themselves, their employer, community and the wider economy (Hogarth, 2007). Graduate attributes address disciplinary knowledge, values and attitudes as well as skills for lifelong learning which potential employers might find desirable. These generic skills have attracted other names over the years such as transferable skills, essential skills, core skills, key competencies, and key skills depending on the national context which they are being developed (Hager, 2006; Hager & Holland, 2006). In the United Kingdom, the emphasis has been on employability skills (Knight & Yorke, 2004), in Europe the prominence is on competencies (Villa et al., 2008) and Australia and Scotland stress on graduate attributes (Hager, 2006; Knight & Yorke, 2006; Yorke, 2006). In Botswana's context, the emphasis is on graduate attributes.

Graduate attributes are usually determined at a university level and then identified at a faculty, and discipline level through a range of approaches including consultations with employers, students and professional bodies for example, accreditation bodies. Universities work to develop graduate attributes in their students by providing academic staff with relevant support and resources, integrating these attributes into the curriculum and course design, providing students with work placements and exposure to professional settings and providing advice and guidance through career services (Cleary et al., 2007). It should be recognised that most students are concurrently develop graduate attributes through part-time employment, volunteer work and community participation. Fieldwork, industry-based

Using a Design-orientated Project to Attain Graduate Attributes

learning, sandwich years, cooperative education, work placements and internships are some methods universities use to equip students with knowledge of current workplace practices. The stronger the link between universities and industry, the greater the opportunities will be to integrate and develop graduate attributes in students. Cleary et al. (2007) outlined the following as the key skills employers require in Australia: Communication skills; teamwork skills; problem solving skills; self-management skills; planning and organising skills; technology skills; life-long learning skills and initiative and enterprise skills.

There is strong research evidence which underscores that discipline-specific knowledge is no longer sufficient for graduate employability (Hager et al., 2002; Treleaven & Voola, 2008). For example, in a study conducted by Garner & Duckworth (2000) on design engineering graduates and their employers in the United Kingdom revealed a deep dissatisfaction with current graduate profiles. The employer's criticism included some of the following actions necessary for graduates to possess the qualities needed:

- improve their listening skills;
- improve higher-quality written, graphic, and verbal communication;
- be critical of their own work and contributions;
- develop a greater ability to take other people's ideas on board;
- develop an ability to muster a reasoned defense of their contribution.

The aforementioned authors further suggest that graduates success in their jobs depends more on graduate attributes than a narrow discipline-specific degree.

A recent study conducted in the United States by the National Association of Colleges and Employers projected the skills that will be needed by employers in 2012 (Job Outlook report 2012, 2011). The survey involved 244 organisations that hire new graduates from institutions of higher learning. Employers rated the skills on a 5-point scale, where 1 = not important; 2 = not very important; 3 = somewhat important and 5 = extremely important. The following are the top ten skills which employers' will be looking for in new graduates (Job Outlook 2012 report, 2011):

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

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, organize 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

Table 1. Employers rating of graduate attributes

Assessment of graduate attributes

There is limited uptake on developing assessment instruments for graduate attributes. This could be attributed to various reasons such as: testing of graduate attributes in most universities is voluntary and therefore, universities are under no obligation to use them (Ballantyne et al., 2004). Some universities assert that administering such an instrument is very expensive when the curricula are already overcrowded (Chanock et al., 2004). Furthermore, employers are not familiar with such assessment tools and they do not utilise the assessment reports (Cleary et al., 2007). Some of the assessment instruments used by some universities include some of the following:

Graduate Skills Assessment

The graduate skills assessment is used to assess university students' generic skills. The test is administered upon university entry and exit. It has four specific areas: problem solving, critical thinking, interpersonal understanding and written communication (Cleary et al., 2007). The rationale behind the entry and exit tests is that students who sit both tests will have a measure of the value added to their skills by their university studies, and the institution will be able to identify the skills gained by their graduates (Boud & Falchikov, 2005). The test consists of a two-hour multiple choice test (similar to that of other psychometric tests) and

Using a Design-orientated Project to Attain Graduate Attributes

a one-hour written test. Chanock et al. (2004) argues that this assessment has limited capacity to measure the way in which skills will be applied in the really work environment.

Employability Skills Profiler

This type of assessment objectively assesses a job seeker against a nationally-consistent generic skills framework, and then matches the job seeker's employability skills to the employability skills required in various occupations (Cleary et al., 2007). This online questionnaire that produces three reports: a job options report, a job fit and development report and an employability skills profile. This assessment needs redevelopment so that it closely fit the graduate context. It is most useful as a careers guidance tool for students thinking about how to reorient their career choices (Boud & Falchikov, 2005). However, the employability skills profiler measures an individual's aptitudes or innate strengths, rather than what has been learned through a university education. As an online multiple choice test it is more limited than the graduate skills assessment in that it does not include a written test.

There are weaknesses on the assessment tools discussed, and what is needed is a robust reliable and valid instrument that will be enables: (a) students to do their self-assessment, (b) academic staff supervisors to assess students in an authentic business setting and professional environment and (c) industrial workplace supervisors to provide feedback on the student performance. This type of assessment will allow the workplace supervisors and the academic staff supervisors to gauge how much they apply their graduate attributes in the work environment and assess discipline-specific skills.

Importance of graduate attributes in the curriculum

According to the University of Tasmania (2009), the focus of graduate attributes in the curriculum includes some of the following:

- It is no longer sufficient for graduates to simply acquire disciplinary knowledge to guarantee them a job at the completion of the undergraduate degree.
- Increasingly, 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 critically, be creative and have sound information technology skills.
- Nowadays, knowledge becomes obsolete quickly. Graduates must be versatile and adaptable to ever-changing work environment. They need to become lifelong learners, open to new ideas and new ways of learning and thinking.
- Graduates need to achieve and demonstrate to

employers their acquisition of graduate attributes that can be applied in a number of contexts.

On the contrary, Barrie (2006); Green et al. (2009) and Haigh & Clifford (2010) report that there are some academics that believe that generic graduate attributes are learnt as part of a discipline-specific knowledge while others view the same as a separate precursor to learning that should be addressed by an additional, remedial curriculum. Moreover, such academics view the inclusion of graduate attributes in the curriculum as imposition and time consuming and unlikely to be tolerated.

University of Botswana graduate attributes

The University of Botswana *Learning and Teaching Policy* (2008) identified relevant generic graduate attributes to be acquired by students in order to respond effectively to society's needs. The attributes represent the skills, knowledge, abilities, values and qualities that must be developed by students at the end of the study period at the University of Botswana irrespective of the discipline. The University of Botswana believes that the identified set of generic graduate attributes should be integrated into the curriculum design and evaluation processes. All programmes in the University of Botswana must encompass the following graduate attributes:

- Information and communication technology knowledge and skills
- Self-directed, lifelong learning skills;
- Critical and creative thinking skills;
- Problem-solving skills;
- Communication skills;
- Entrepreneurship skills;
- Organisational and teamwork skills;
- Research skills;
- Social responsibility;
- Leadership skills;
- Interpersonal skills;
- Cross-cultural skills;
- Accountability and ethical standards.

Benefits of graduate attributes in the curriculum

Evidence from the literature support the fact that, there are benefits to be obtained from integrating graduate attributes in the curriculum (Barrie, 2006; Holmes, 2002; Bowden et al., 2000; Hogarth, 2007; Goldsworthy, 2003; Hager & Holland, 2006). Some of the benefits include the following:

- If graduate attributes are integrated in the curriculum, the institutions of higher learning will be in a position to meet employers' needs by producing a competent workforce. These professionals will possess broad capabilities in addition to discipline-related skills.

Using a Design-orientated Project to Attain Graduate Attributes

- Students will be well grounded for the ever-changing work environment by acquiring a broad range of skills such as effective communication, problem-solving, critical thinking and teamwork skills (Nettleton et al., 2008).
- Mapping graduate attributes focuses curriculum planning, implementation and evaluation. Curriculum design, teaching and learning strategies and assessment activities will reflect a commitment to supporting students to achieve graduate attributes as well as discipline-related knowledge and skills.

Teaching and learning approaches

The integration of the graduate attributes has led to a range of variations from teacher-centred to learner-centred approaches and the learning community engagement approaches, with the resultant differences in the quality of the learning outcomes achieved (Barrie, 2004). This change is necessitated by the fact that some generic skills are complex and interwoven aspects of human ability, which are difficult to explicitly teach or assess in the traditional way. Therefore, it is useful to develop teaching strategies that will effectively promote the development of graduate attributes (Barrie, 2007; Hager et al., 2002; Goldsworthy, 2003). The agenda of universities has now shifted to producing students who can demonstrate disciplinary knowledge as well as generic graduate attributes. This obviously challenges the educator's role in the classroom. Do students develop such attributes independently or is there a role for educators to guide students in developing these attributes? The emphasis should be on how these attributes can be acquired or developed by students and the role of teaching strategies used by the educators to foster such attributes. Barrie (2007) argues that it is important for educators to understand the teaching and learning of such attributes that is; what is it that is taught/learnt and how is it taught/learnt?

Barrie (2004; 2007) reports that for many educators, the idea that graduate attributes should be a focus of their teaching is not one to which they subscribe, not because they are resistant or unaware of how to teach, but because their understanding of the nature of graduate attributes is incompatible with their understanding of what university teaching and learning is all about. Barrie et al., (2009) further argue that despite the rhetoric of graduate attribute policy and the espoused claims of statements of course learning outcomes, the reality is that teaching in some courses has not changed from a model of transmission of factual content.

Project-based learning approach

Learner-centred approaches to teaching have been used by educators to assist students to attain generic graduate attributes. For example, the Project-Based Learning (PBL) is one such learner-centred approach which enables students to connect knowledge, skills, values and attitudes and construct knowledge through a variety of learning experiences (Lam et al., 2009; Buck Institute for Education (BIE), 2003; Barron, 1998; Blumenfeld et al., 1991; Brears & O'Sullivan, 2011; Duch et al., 2001). Therefore, PBL provides the contextual environment that makes learning exciting and relevant.

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 (BIE, 2003).

Brears & O'Sullivan (2011) state that the philosophical foundation for PBL aligns with cognitive theories argued by John Dewey of learning by doing that is, emphasising practical experience in learning. In PBL students work in small collaborative groups tackling complex tasks based on challenging driving questions that are anchored in a real-world problem. Educators act as facilitators of the learning process. Students participate in design, problem-solving, decision making or investigating activities to meaningfully address the driving question (Blumenfeld et al., 1991). On the same note, Lam et al. (2009); BIE (2003); Marx et al. (1994) also emphasise that students pursue solutions to a problem by asking and refining questions, debating ideas, making predictions, designing solutions by using technology, collecting and analysing data, drawing conclusions, communicating their findings to others, asking new questions and creating products (Figure 2). PBL gives students the opportunity to work relatively autonomously over an extended period of time and culminate in realistic products.

The PBL model proposes that students go through an extended process of inquiry in response to a complex question or problem. In implementing the model, there should be room to allow the students voice and choice in decision making. In meticulous projects, there should be measures put in place to ensure careful planning, management and proper assessment procedures to assist students learn key academic content and practice 21st century generic skills.

Project-based learning promotes self-directed and lifelong learning capabilities, increases students' motivation, equips students with transferrable knowledge and skills that are essential to the work environment, intertwines theory and

Using a Design-orientated Project to Attain Graduate Attributes

practice, enable students to gain a deep understanding of concepts and allow students to solve the society's problems (Lam et al., 2009; Hmelo-Silver, 2004; Grant, 2002; Savage et al., 2009; Brears & O'Sullivan, 2011).

Project-based learning in practice

Prince & Felder (2006) report that a number of institutions have made PBL the focus of many or most of their engineering programmes and this includes the universities of Aalborg and Roskilde in Denmark, Bremen, TU Berlin, Dortmund and Oldenburg in Germany, Delft and Wageningen in Netherlands, Monash and Central Queensland University in Australia and Olin College in the United States. A number of studies offer evidence that most students who experience PBL eventually come to favour it over traditional methods (Vernon & Blake, 1993; Dods, 1997; Lieux, 1996; Hung et al., 2003; Caplow et al., 1997). Furthermore, other scholars argue that PBL leads to positive retention outcomes, develops skills and an understanding of interconnections among concepts, develops deep conceptual understanding, enables students to apply appropriate metacognitive and reasoning strategies, develops teamwork skills and promotes self-directed learning (Prince & Felder, 2006; Gijbels et al., 2005; Vernon & Blake, 1993; Chung & Chow, 2004, Sharp & Primrose, 2003; Blumberg, 2000).

At the University of Queensland, Jolly (2009) states that 82% of the first year students who participated in the PBL challenge organised by the Engineers without Borders (EwB) felt that the project exposed them to real-life experiences. Students were highly motivated by the opportunity to improve the lives of other human beings and they enjoyed being problem-solvers as well as the development of friendships by working together in teams. The EwB challenge is a national design project done by 26 universities across Australia and New Zealand. The project is targeted to first year university students to provide them with an opportunity to learn about design, sustainable development, teamwork and communication through real-life and inspiring sustainable development projects. Graham (2009) reports that a number of partner universities involved in the EwB project point out that this is the most successful project-based learning experience in their curriculum.

According to Mills & Treagust (2004) the reviewed published evaluation of the PBL in design and engineering indicates that students have a better understanding of issues of professional practice as well as demonstrate their abilities to apply their acquired learning skills to realistic problems. The outcomes for the PBL taught students could be attributed in part to their perception of greater support

from their lecturers, a factor known to have a positive impact on both performance and attitudes (Prince & Felder, 2006).

Project-based learning and the design process

There is a symbiotic relationship between the PBL and the design process. Both approaches equip learners with knowledge, skills, values and attitudes through self-directed lifelong learning enquiry. Some researchers (Doppelt, 2009; Thomas, 2000; Dym et al., 2005) posit that both processes:

- Start with a challenge or need to be solved;
- Engage students in a constructive investigation which involves design, problem-solving; decision-making, discovery, model-making processes and presentations;
- Involve students-driven projects which are the central teaching strategy used to learn core concepts of the discipline;
- Engage students in realistic projects thus incorporating real-life challenges where the focus is on authentic problems and the solutions generated have the potential to be implemented.
- Both processes have the potential to enhance deep understanding because students need to acquire and apply information, concepts and principles.

However, the point of difference between the two approaches is that the PBL has a stage in its process which requires students to learn and practice 21st century generic skills (Figure 2). Such skills follow under these domains: information and communication technology, cognitive skills, inter-personal skills, self and task management skills and personal characteristics. Under this particular stage, students need to reflect on and discuss the skills that are cultivated and reinforced in the project. Students will be introduced to the teaching strategies essential for fostering these skills. Thereafter, students can reflect on how these skills and teaching methods relate to their own practice and experiences (Blumenfeld et al., 1991). On the contrary, the design process does not have a specific stage which is similar to the project-based learning which deals with the acquiring of generic graduate attributes. It can be assumed that these skills are embedded within the design process.

The focus of this paper reports on the feedback students gave as part of the attainment of the different graduate attributes after undertaking a design-orientated project. The authors reflect on the self-assessment of students feedback about the impact of project-based learning can have on attaining graduate attributes as well as lessons learnt from undertaking a client-driven project.

Using a Design-orientated Project to Attain Graduate Attributes

Research Method

A case study was conducted at the University of Botswana with 21 fifth year Bachelor of Design students. The structure of the design programme is illustrated at Figure 1. The structure of the programme has a science base at first year level. In the second year, students do a common engineering foundation with the introduction of a few design courses. From third to fifth year, students then focus on core design courses.

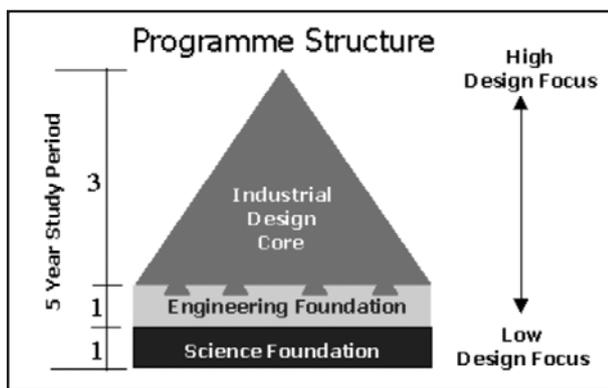


Figure 1. Structure of the Bachelor of Design programme at the University of Botswana (Molokwane et al., 2009)

The project was conceived under a packaging design course they took as an option in their programme. A case study was chosen to be used in this study because it is an empirical inquiry that investigates a phenomenon within its real-life context (Yin, 2003). The approach allows the researcher to explore individuals or organisations, through interventions, relationships, communities or programmes and supports the deconstruction and the subsequent reconstruction of various phenomena (Baxter & Jack, 2008; Yin, 2003). Close collaboration between the researcher and participant enables participants to tell their stories (Crabtree & Miller, 1999). It is through these stories that participants are able to describe their views of reality and this enables the researcher to better understand the participant's action. When this approach is applied correctly, it becomes a valuable method of design research to develop theory, evaluate programmes and develop interventions because of its flexibility and rigour.

Sampling

A small up-coming entrepreneur was identified through the assistance of the Local Enterprise Authority, an organisation tasked with promoting entrepreneurship and Small Medium Micro Enterprises (SMME) in Botswana on an opportunistic basis. The entrepreneur was also selected on the basis of easy accessibility to design students, and financial constraints.

Procedure

The procedure of the study involved students being given a brief to design packages of the following frozen products produced by the entrepreneur: bream fish, bream fillets, mixed vegetables, stir fries, diced butternuts and potato chips. After students had been given the design brief, they were divided into five groups of four students each and their task involved auditing the brand, drawing up an appropriate design strategy, designing the company's brand and stationary and packages. During the designing of the project, there were three presentations in which the entrepreneur and users were involved to give their feedback. After the first presentation, one signature was selected to be used in all the products. All groups were to refine their package design concepts using the selected signature and incorporate input from the entrepreneur and users. This made the product more focussed. After the second presentation, the best package design concepts for each product were selected from all the groups. Thereafter, there were minor refinements which were done as per the feedback from the entrepreneur and users. The third presentation involved refining the signature and designs and delivering the final artwork to the entrepreneur.

Instruments

At the end of the design project, a questionnaire was administered to students based on a five-point scale. Students rated the level of attainment of the 14 graduate attributes outlined in the Learning and Teaching Policy of the University of Botswana (2008) against the five point scale. A score of 1 represented (poor) attainment, 2 (satisfactory), 3 (good), 4 (very good) and 5 (excellent). Furthermore, students reflected on some open-ended questions on what they liked about the project, explained why they have rated some graduate attributes 2 or below and outlined what aspects can be improved in future design projects.

Data analysis

All quantitative items were analysed using SPSS software. The data analysis concerning students' attainment of graduate attributes was done by calculating the mean scores on the attitude scale. To achieve this, numerical scores were assigned to five response options given to each item on the attitude scale. Then data was entered into SPSS data editor for analysis. The main aim was to find out how the objects of the study (students) and the variables of the study (questions on graduate attributes) are related to each other. The data on attaining graduate attributes was analysed by using frequencies, means and percentages. Qualitative data was coded and analysed using Atlas.ti software and reported in emergent themes. The overall data was presented in terms of tables, graphs and text.

Using a Design-orientated Project to Attain Graduate Attributes

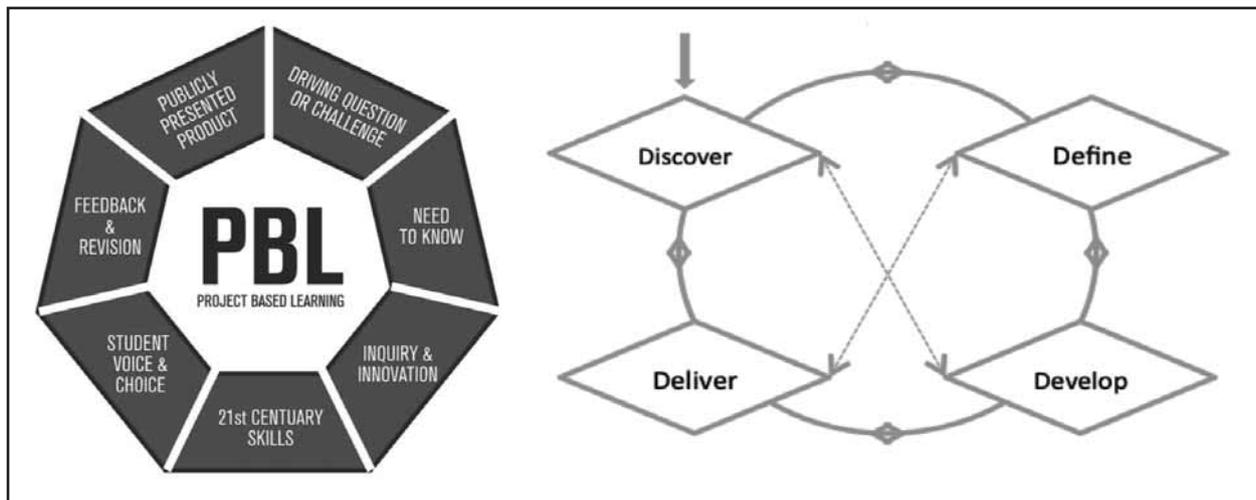


Figure 2. Project-based learning model (BIE, 2003) Figure 3 Design process (after Design Council, 2005)

Results

The project was conceived using the PBL model (Figure 2) in conjunction with the design process (Figure 3). Figure 3 maps the divergent and convergent stages of the design process, showing the different modes of thinking designers use (Design Council, 2005). The combination of the PBL model and the design process resulted in an appropriate business-design solution for the entrepreneur (Figure 4). The iterative design process (Figure 4) was developed for this project because when solving the identified design problem, it was necessary to go back to the previous steps at any given point in the process. This was done because the chosen concepts at times proved unworkable for a numbers of reasons and it required redefining the problem, collecting more information or generating different concepts.

The business-design model (Figure 4) starts with the **project initiation** it is basically the problem identification and definition stage with the entrepreneur. The entrepreneur outlined the needs and goals of the project as well as provided relevant background information on the products being sold such as nutritional value of different vegetables and fish. This stage also involved planning sessions on how the project should be managed and developed. The **research** phase involved students conducting user and market research. It is important to incorporate the needs of the users in the development of the new package designs. This assisted in assessing the competitive landscape of similar package designs as well as to assess the current trends used in package design. The **synthesis** stage involved the analyses of the data collected during the research phase. The data was presented to the entrepreneur for input and approval. This

information provided a springboard for creativity in conceiving new innovative designs. The **design and development** stage included conceiving several concepts and then presenting them to the entrepreneur to select the most promising concepts for development. Furthermore, the promising concepts were refined and developed into a single concept. The refined concept was presented to the entrepreneur for approval and further modifications were made. The **implementation and delivery** stage involved the ultimate approval of the refined concept by the entrepreneur. The package designs were then prepared for printing and handed over to the client to start marketing the products. The students and the client had a debriefing meeting to review the outcome of the project.

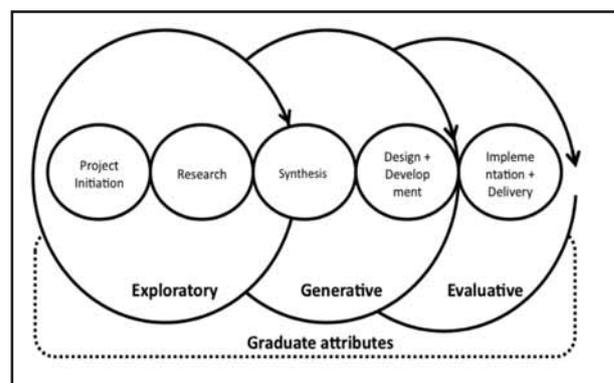


Figure 4. Business-design process

Throughout the three core stages of exploratory, generative and evaluative, the graduate attributes were identified and reflected upon at each stage. This ensured that there is a conscious effort to encode the graduate attributes throughout the process (Figure 4). During the project,

Using a Design-orientated Project to Attain Graduate Attributes

students interacted with the entrepreneur, retail shops, users, lecturers and amongst themselves as individuals and at team level. It is during such interaction with various stakeholders that some key graduate attributes were developed such as communication skills, critical thinking skills, problem-solving skills and interpersonal skills, organisational and teamwork skills.

The foci of the study were to evaluate how many graduate attributes students believed they attained after undertaking this package design project as per their own ratings. Figure 3 shows that no respondent rated the attainment of the graduate attributes as poor, and (2%) rated them as satisfactory, (29%) as good (45%) as very good and (24%) as excellently attained (Figure 3).



Figure 5. Overall perceived attainment of graduate attributes

The overall results show that 20 students perceived that they have attained graduate attributes by undertaking this project (Figure 5).

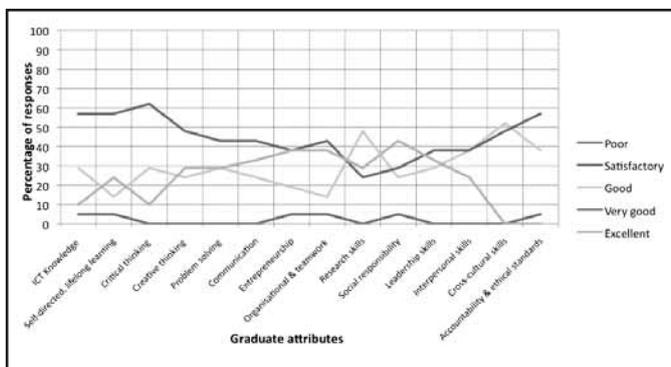


Figure 6. rating and comparison of the graduate attributes attainment

By undertaking this project, it became clear that students claimed that the following skills were excellently attained as illustrated in Figure 6; social responsibility (43%), organisation and teamwork skills (38%), entrepreneurship skills (38%), communication skills (33%) and leadership skills (33%).

The graduate attributes rated very good to excellent (Figure 7) include the following: information and communication technology knowledge and skills (67%), Self-directed, lifelong learning skills (81%), Critical thinking skills (71%), creative thinking skills (76%), problem-solving skills (71%), communication skills (76%), entrepreneurship skills (76%), organisational and teamwork skills (81%), social responsibility (71%) and leadership skills (71%).

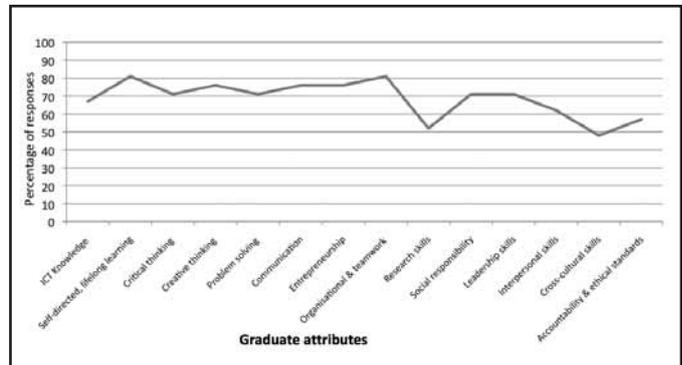


Figure 7. Attributes rated very good or excellent

These generic skills scored from very good to excellent forms the core skills perceived to have been attained during the process of undertaking the package design project. The stated skills tally those outlined by respondents qualitatively as the aspects they liked about the project. For example, one participant indicated that "...undertaking this project will help us to be self-employed". It is worth noting that respondents indicated in Figure 6 that this project assisted them to develop and refine their self-directed, lifelong learning skills (81%) as well as organisational and teamwork skills (81%).

After students rated the perceived attainment of the graduate attributes, respondents were asked to respond qualitatively to three aspects. The first aspect was for respondents to reflect on what they liked about the project. Some respondents indicated that they gained a lot of valuable experience which they will use beyond the classroom environment. They stated that;

It was an exciting learning experience.

I was able to gain experience working on a real-life problem.

Using a Design-orientated Project to Attain Graduate Attributes

...it was a great experience which needs to be done often. It was an eye-opener as to what exactly is happening in the outside world.

Furthermore, respondents liked the involvement of making a product for a real-life client. They expressed this by saying:

Getting to work with a real-life client was a valuable aspect I liked on this project.

Having to design something for a client was quite interesting and challenging at the same time.

I liked the involvement of the Local Enterprise Authority people.

The project linked the graduate with the market...

Respondents also appreciated the way the project was coordinated and conducted. Their views were as follows:

The project was well conducted...

...keep doing such projects with business people.

You should assign projects like these to students in the future.

The following areas need to be improved in future as per the respondents' recommendations. They expressed that the client was not providing certain information they needed to use on the package designs. One respondent also echoed that *"communication with the client need to be improved"*. Some respondents stated that at the beginning of the project, some students attitude towards the project was negative and *"...need to be changed to a positive one."* Others outlined that groups of 4-5 students caused some logistics problems and in future we should consider pairing or forming groups of 3 students. Moreover, they suggested that in future the project should be run as a competition amongst the groups as expressed by this respondent: *"...incorporate some sort of competition between groups to encourage students to put more effort on the project"*.

Another area which needs serious consideration was ethical and sustainability issues. The packages were designed using plastic (low density polyethylene) which is not environmental friendly. It was observed that *"the issue of ethics were not quite looked at in the sense that the project did not bring in more ecological and environmental issues."*

Having discussed the feedback from students, the entrepreneur was also interviewed to give the overall impression of the project pertaining to the attainment of the graduate attributes. At first, he indicated that some big retail supermarkets rejected his products because the package designs were of low quality. His package designs used to have a sticker pasted on a transparent plastic

package (Figure 8). He sells diced carrots, and green peas but the old package was showing vegetables which were not diced (Figure 8).



Figure 8. Sticker that was used

The entrepreneur was happy that the project output will enable his company to actively compete favourably in the marketplace. The new package design meets the Botswana Bureau of Standards food packaging requirements (Figure 9).

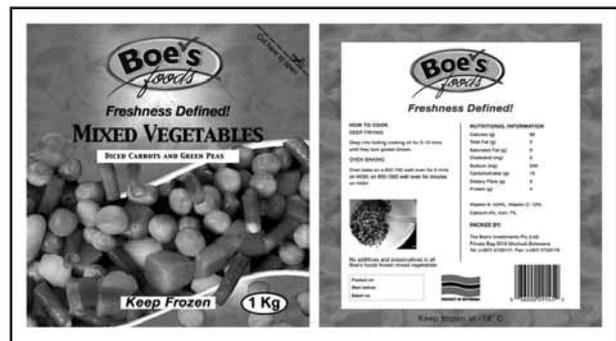


Figure 9. Front and back view of the new package design

In terms of the attainment of graduate attributes by students, the entrepreneur stated that:

...I think they have attained most of them such as research skills. ...they shared with me their research output especially the trends in food packaging design which has helped to improve the current design.

We had an open communication line through emails, phone and face-to-face interaction during lively presentations.

I also liked the idea of students working as different companies. This helped to develop their teamwork and interpersonal skills because success in business relies on collaboration and teamwork...

The above excerpts show that the entrepreneur felt that students developed their research skills, communications skills, organisational and teamwork skills and interpersonal skills.

Using a Design-orientated Project to Attain Graduate Attributes

Furthermore, the entrepreneur observed that:

With regard to problem-solving skills, students managed to solve the problem at hand because they have delivered an innovative solution...

The final solution was creatively thought of as the new logo truly represents the company's vision, mission and values.

Above all, students did not charge me for their services and I think you are imparting the right social responsibility skills... Your students should continue assisting other entrepreneurs who are facing similar problems. ...they are many of us who struggle with branding and packaging our products.

The entrepreneur verifies some of the students claim pertaining to the attainment of various graduate attributes. He believes that by undertaking this project, students also developed problem-solving skills, creativity skills and social responsibility skills.

Discussion

The results show a positive response from students after undertaking a project done through the PBL approach. This is not surprising because a number of scholars have also alluded to the fact that students taught through the PBL approach develop a positive attitude towards learning and this approach also improves their academic performance (Mills & Treagust, 2004; Caplow et al., 1997; Hung et al., 2003; Jolly et al., 2009). PBL promotes students adoption of a deep (meaning-orientated) approach to learning as opposed to a surface (memorisation-intensive) approach.

The results also indicated that respondents rated self-directed and lifelong learning and organisation and teamwork skills at 81% each. This fact is also substantiated by Prince & Felder (2006) that PBL enables students to acquire critical thinking skills, develop teamwork skills and self-directed learning skills. These are some of the core skills which are not easy to teach in a theoretical environment but students need to be given an opportunity to practice them as per John Dewey's concept of learning by doing. Employers are looking for such skills in an employee that is, an individual who is ready to learn new skills and can work in a dynamic environment in teams.

Social responsibility was also rated excellent because respondents felt an obligation of giving back something to the community especially to a small entrepreneur who is struggling to enter the highly competitive market. This in a way also acted as contributing to the corporate responsibility of the University of Botswana to the society. The project inculcated a value and skill which is highly needed in the society and students will use it in their

future endeavours to behave ethically and with sensitivity towards social, cultural, economic and environmental issues. Ditlev-Simonsen (2010) argues that striving for social responsibility helps individuals, organisations and governments to have a positive impact on development, business and society with a positive contribution to bottom-line results.

The merging of the PBL process and design process has produced an interesting model that could be used to assess students' views on the attainment of graduate attributes in an educational environment. The ultimate business solution model is not only focussed on the business output but also dovetailed in the educational outcomes. It delivers the right design solution to the client and provides a mechanism to assess how much students felt they have attained generic graduate attributes which have become an important issue in higher education. Another observation is that the merging of the PBL process and the design process raises the level of enthusiasm in participation on the part of the students, as they can see the practical manifestation and consolidation of their knowledge and skills in a real project beneficial to society. The aptitude and attitude is therefore elevated to newer levels, having an overall positive effect on the delivery.

The other generic attributes which were highly rated by respondents include critical thinking skills, creative thinking skills, problem-solving skills, communication skills, leadership skills and entrepreneurship skills (Figure 6). These were the core generic skills perceived to have been attained by students during the process of designing the packages. This shows that the project partly achieved its intended educational goal because a lot of graduate attributes were perceived to have been successfully attained as per the views of the students and the entrepreneur.

Conclusion

The study has demonstrated that well managed project-based learning can assist students in higher learning institutions in attaining graduate attributes. Graduate attributes are the generic skills that employers are looking for in employees in the ever-changing work environment. Institutions of higher education have a major responsibility for the smooth integration of graduates into professional life and society. Therefore, it is the responsibility of these institutions to develop modern curricula and course designs that build students knowledge and skills in a cohesive framework. The curricula should incorporate some of the broad attributes such as practical application, theoretical understanding, creativity and innovation. The evidence from the literature shows that institutions of

Using a Design-orientated Project to Attain Graduate Attributes

higher education can no longer treat generic attributes as already mingled in the discipline-specific attributes.

Employers need workers who are adaptable, flexible, team workers, who can communicate well, critical and creative thinkers and who can solve problems as they arise. The design students at the University of Botswana have indicated through their graduate attributes ratings that they believe that they attained 98% of the same rated from good to excellent. The assessment was only based on students' opinions and it does not include the employers' point of view. A tracer studies will need to be conducted to compare students' views against those of the employers on the subject area. The results clearly indicate that:

- Students and entrepreneur felt that the graduate attributes can be attained through engaging in a real-life project by solving problems faced by the society.
- The effective approach of attaining graduate attributes were hinged in the concept of learning by doing thus engaging students in integrated activities that intimately link theory and practice.
- Students experimented with various real-life solutions to the problem identified and this built a long lasting impression in their personal and professional development as per the comments they made on the aspects they liked about the project.

The societal, industrial changes and demands dictate that the Universities have to continually adapt their teaching-learning methodologies to be relevant, appropriate and effective to address the attainment of graduate attributes. This necessitates a shift from teacher-centred to learner-centred approaches. One approach that has been found to cultivate the attainment of graduate attributes, making them relevant and contextual to societal needs, is project-based learning, integrated into the knowledge and skills of the students and adapting them to industry requirements and rigour.

References

- Ballantyne C., Lowe, K. & Marshall, L. (2004), '*What employers want: an initiative in testing graduate attributes and informing curriculum*'. Available online at <http://www.herdsa.org.au/conference2004/Contributions/NRPPapers/PO52-jt.pdf>. Retrieved November 8, 2011].
- Barrie, S. C., Hughes, C. & Smith, C. (2009) '*The National graduate attributes project: Integration and assessment of graduate attributes in curriculum*'. Sydney: Australia Learning and Teaching Council.
- Barrie, S. C. (2007) 'A Conceptual framework for the teaching and learning of generic graduate attributes'. *Studies in Higher Education*, 32, 4, 439-458.
- Barrie, S. C. (2006) 'Understanding what we mean by generic graduate attributes of graduates'. *Higher Education*, 51, 2, 215-241.
- Barrie, S. C. (2004) 'A research-based approach to generic graduate attributes policy'. *Higher Education Research and Development*, 23, 3, 261-275.
- Barron, B. (1998) 'Doing with understanding: Lessons from research on problem-and project-based learning'. *Journal of the Learning Sciences* 7, 3, 271-311.
- Baxter, P. & Jack, S. (2008) 'Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers'. *The Qualitative Report*, 13, 4, 544-559.
- Blumberg, B. (2000) 'Evaluating the evidence that problem-based learners are self-directed learners: A review of the literature'. In D. H. Evensen and C. E. Hmelo, (eds.), *Problem-based learning: A research perspective on learning interactions*, Mahwah, NJ: Erlbaum, 199–226.
- Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M. & Palinscar, A. (1991) 'Motivating problem-based learning: Sustaining the doing, supporting the learning'. *Educational Psychologist*, 26, 3, 369-398.
- Boud, D. & Falchikov, N. (2005) 'Redesigning assessment for learning beyond higher education'. *Research and Development in Higher Education*. In A. Brew & C. Asmar (eds), Sydney: HERDSA 28, 34–41.
- Bowden, J., Hart, G., King, B., Trigwell, K. & Watts, O. (2000) *Generic capabilities of ATN University graduates*. Canberra: Australia Government Department of Education, Training and Youth Affairs. Available online at <http://www.clt.uts.edu.au/ATN.grad.cap.project.index.html/> [Retrieved March 1, 2011].
- Brears, L. & O'Sullivan, G. (2011) 'Preparing teachers for the 21st Century using PBL as an integrating strategy in Science and Technology'. *Design and Technology Education: An International Journal*, 16, 1, 36-46.
- Buck Institute for Education (2003), *Project-based learning handbook: A guide to standards-focused project based learning for middle and high school teachers*. Novato, CA: Buck Institute of Education.

Using a Design-orientated Project to Attain Graduate Attributes

- Cleary, M., Flynn, R., Thomasson, S., Alexander, R. & McDonald B. (2007), *Graduate employability skills*. Department of Education, Victoria, Australia. Available at <http://www.dest.gov.au/highered/bihecc>. [Retrieved November 9, 2011]
- Castello, J. J. (2009), *Non-probability sampling*. Available online at <http://www.experiment-resources.com/non-probability-sampling.html>. [Retrieved March 2, 2011]
- Caplow, J. H., Donaldson, J. F., Kardash, C. A., and Hosokawa, M. (1997) 'Learning in a problem-based medical curriculum: Students' conceptions'. *Medical Education*, 31, 1–8.
- Chanock, K., Clerehan, R., Moore, T. & Prince, A. (2004) 'Shaping university teaching towards measurement for accountability: Problems of the graduate skills assessment'. *Australian Universities Review*, 47, 1, 22-29.
- Chung, J. C. C., and Chow, S. M. K. (2004) 'Promoting student learning through a student-centered project-based learning subject curriculum', *Innovation in Education and Teaching International*, 41, 2, 157–168.
- Crabtree, B. & Miller, W. (eds) (1999), *Doing qualitative research*. London: SAGE
- Design Council (2005), '*The design process*'. Available online at <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/> [Retrieved November 16, 2011].
- Ditlev-Simonsen, C. D. (2010) 'From corporate social responsibility awareness to action?' *Social Responsibility Journal*, 6, 3, 452-468.
- Dods, R. F. (1997) 'An action research study of the effectiveness of problem-based learning in promoting the acquisition and retention of knowledge', *Journal for the Education of the Gifted*, 20, 423–437.
- Doppelt, Y. (2009) 'Assessing creative thinking in design-based learning'. *International Journal of Technology and Design Education*, 19, 1, 55-65.
- Duch, B. J. Groh, S. E. & Allen, D. E. (eds) (2001), *The power of problem-based learning: A practical "how to" for teaching undergraduate courses in any discipline*. Sterling, VA: Stylus Publishing.
- Dym, C. L., Agogino, A. M., Frey, D. D. & Leifer, L. J. (2005) 'Engineering design thinking, teaching and learning'. *Journal of Engineering Education*, 94, 1, 103-120.
- Garner, S. & Duckworth, A. (2000), The employability of design graduates: A study of competencies achieved through undergraduate design education. In C. A. Y. E. Swann, (ed) *Re-inventing Design Education in the University*. Perth, Curtin University of Technology.
- Gijbels, D., Dochy, F., P. Van den Bossche, P. & Segers, M. (2005) 'Effects of project-based learning: A meta-analysis from the angle of assessment'. *Review of Educational Research*, 75, 1, 27–61.
- Goldsworthy, A. (2003), *Developing generic skills: examples of best practice*. B-HERT News, 16, April. Available online at http://www.bhert.com/documents/B-HERTNEWSNo.16_001.pdf [Retrieved March 2, 2011].
- Graham, R. (2009), *UK approaches to engineering project-based learning*. Available online at <http://web.mit.edu/gordonelp/ukpjbwhitepaper.pdf>. [Retrieved September 9, 2011].
- Grant, M. M. (2002) 'Getting the grip on project-based learning: Theory, cases and recommendations'. *Meridian: A Middle School Computer Technologies Journal*, 5, 1. Available online at <http://www.ncsu.edu/meridian/win2002/514/index.html> [Retrieved March 10, 2011].
- Green, W., Hammer, S. & Star, C. (2009) 'Facing up to the challenge: why is it so hard to develop graduate attributes', *Higher Education Research and Development*, 28, 1, 17-29.
- Hager, P. J. (2006), *Nature and development of generic attributes*. Dordrecht: Springer.
- Hager, P. J. & Holland, S. (2006), Nature and development of generic attributes. In P. J. Hager & S. Holland (eds), *Graduate attributes, learning and employability*, 17-47. Dordrecht: Springer.
- Hager, P. J. & Holland, S. & Beckett, D. (2002), *Enhancing the learning and employability of graduates: the role of generic skills*. Business/Higher Education Round Table Position Paper No. 9. Melbourne, Australia.
- Haigh, M. & Clifford, V. (2010) 'Widening the graduate attribute debate: A higher education for global citizenship', *Brookes eJournal of Learning and Teaching*, 2, 5.

Using a Design-orientated Project to Attain Graduate Attributes

Hmelo-Silver, C. E. (2004) 'Problem-based learning: What and how do students learn?' *Educational Psychology Review*, 16, 235-266.

Hogarth, T. (2007), *Employer and university engagement in the use and development of graduate level skills*, Department of Education and Skills Research Report RR835A. Available online at <http://aces.shu.ac.uk/employability/resources/RR835A.pdf>. [Retrieved March 2, 2011].

Holmes, L. (2002) 'Reframing the skills agenda in higher education: graduate identify and double warrant'. In D. Preston (Ed.), *University of crisis*. London: Rodopi press.

Job Outlook 2012 report (2011), National Association of Colleges and Employers. Available online at http://www.naceweb.org/job_outlook_2012/. [Retrieved November 7, 2011].

Jolly, L., Crosthwaite, C. & Brown L. (2009), *Program logic approach to evaluating educational innovation*. Proceedings of the Research in Engineering symposium 2009, Palm Cove, QLD.

Hung, W., Bailey, J. H., & Jonassen, D. H. (2003), 'Exploring the tensions of problem-based learning: Insights from research'. In D. S. Knowlton & D. C. Sharp, (eds), *Problem-Based Learning in the Information Age*, New Directions for Teaching and Learning, 95, San Francisco: Jossey Bass, 13–23.

Knight, P. & Yorke, M. (2006), *Employability: judging and communicating achievement*, Berkshire: Open University Press.

Lam, S. F., Cheng, R. W. & Ma, W. Y. K. (2009) 'Teacher and student intrinsic motivation in problem-based learning'. *Instructional Science*, 37, 6, 565-578.

Lieux, E.M. (1996), 'A comparative study of learning in lecture vs. problem-based format', *About Teaching*, No. 50, Center for the Effectiveness of Teaching and Learning, University of Delaware.

Marx, R. W., Blumenfeld, P. C., Krajcik, J. S., Blunk, M., Crawford, B., Kelly, B. & Meyer, K. M. (1994) 'Enacting project-based Science: Experiences of four middle grade teachers'. *The Elementary School Journal*, 94, 5, 517-538

Mills, J. E. & Treagust, D. F. (2004) 'Engineering education—Is problem-based or project-based learning the answer?' *Australasian Journal of Engineering Education*. Available online at http://www.aeee.com/journal/2003/mills_treagust03.pdf [Retrieved on September 8, 2011].

Molokwane, S., Khumomotse, S. & Moalosi, R. (2009), *Design programmes' responsiveness to economic, ecological and social imperatives: The case of the University of Botswana*. Proceedings of the MX Design Conference 2009, Mexico city, Mexico, 28 - 30 October 2009. Available online at <http://www.designer.com/jump/news/16871>. [Retrieved on September 9, 2011]

Nettleton, S., Litchfield, A. & Taylor, T. (2008), *Engaging professional societies in developing work-ready graduates*. Proceedings of the 31st Annual International HERDSA Conference, 1-4 July, Rotorua, New Zealand, 241-251. Available online at <http://www.hersa.org.au/up-content/uploads/conference/2008/media/Nettleton.pdf> [Retrieved March 1, 2011].

Prince, M. J. & Felder, R. M. (2006) 'Inductive teaching and learning methods: definitions, comparisons, and research bases'. *Journal of Engineering Education*, 95, 2, 123-138.

Savage, R. N., Chen, K. C. & Vanasupa, L. (2009) 'Integrating project-based learning throughout the undergraduate engineering curriculum'. *Engineering Management Review*, 37, 1, 25-30.

Sharp, D. M. M. & Primrose, C. S. (2003) 'The 'virtual family': An evaluation of an innovative approach using project-based learning to integrate curriculum themes in a nursing undergraduate programme'. *Nurse Education Today*, 23, 219–225.

Thomas, J. W. (2000), *A review of research on project-based learning*. Available online at http://www.bie.org/research/study/review_of_project_based_learning_2000. [Retrieved September 21, 2010].

Treleaven, L. & Voola, R. (2008) 'Integrating the development of graduate attributes through constructive alignment'. *Journal of Marketing Education*, 30, 2, 160-173.

University of Botswana (2008), *Learning and teaching policy*. Available online at <http://tirisano/Academic%20Affairs%20Policies/Learning%20and%20Teaching%20Policy%20-%20Approved%20by%20Senate%2020-2-08.pdf>. [Retrieved March 1, 2011].

Using a Design-orientated Project to Attain Graduate Attributes

University of Tasmania (2009), *Developing generic graduate attributes and tracking their acquisition at UTAS*. Available online at http://www.teaching-learning.utas.edu.au/data/assets/pdf_file/0005/1103/GAdeveloping_and_tracking.pdf. [Retrieved April 14, 2011].

Vernon, D. T. A. & Blake, R. L. (1993) 'Does problem-based learning work? A meta-analysis of evaluative research', *Academic Medicine*. 68, 550–563.

Villa, A., Gonzelez, J., Auzmendi, E., Beza-nilla, M. J. & Laka, J. P. (2008) 'Competences in the teaching and learning process'. In J. Gonzalez & R. Wagenaar (eds), *Universities contribution to the Bologna process* (2nd ed., 25-54), Spain: Turning Project.

Yin, R. K. (2003), *Case study research, design and methods*, Newbury Park: Sage Publications.

Yorke, M. (2006), *Employability in higher education: what it is – what it is not, learning and employability series*. Berkshire: Open University Press.