Graduating Outcome Based Education Diploma in Science Students': Insight Achievement

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ABSTRACT

Graduating year is the most important year in students' life. Academic excellences with good personal qualities are displayed in their seniority. Students ought to accomplish some parts of the specific knowledge and skills, as addressed in the Malaysia Qualification Framework by the Ministry of Education (formerly known as Ministry of Higher Education). This system is well known as outcome based education (OBE). Every program offered in the university has to line up with the OBE documents, proposing the ideal outcome of their respective graduate. However, the students' actual performance is yet to be measured. Hence, this paper will be conferring on the Diploma in Science (AS120) students' perception on their own achievement in completing the programme. An open ended questionnaire were distributed to AS120 graduating students in the second semester of December 2012-April 2013, comprising of 44 and 30 students of part five and part six, respectively. The students' insights were found contradictory with the outcome of programme. Moreover, the cognitive achievement measured by sub-sampling the respondents in a biology written test found that the students overestimated their capabilities. Some of the students were found, surprisingly, to have little or no knowledge of OBE system in our earlier approach. Nonetheless, they agreed that some activities in the class and assessment justification by the lecturers covered their cognitive, psychomotor and affective skills. As conclusion, although the OBE was implemented throughout the years, the AS120 graduating students are yet far from acknowledging the details of the OBE system. Students were also suggesting that they improve their learning skills via psychomotor activities such as laboratory works, rather than having lectures.

Keywords: *graduating, student, outcome based education, Diploma in Science*

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Introduction

Diploma in Science (AS120) is one of the pioneer science programmes in Institut Teknologi MARA (ITM) back on 1967. ITM was later upgraded and honoured as one of Malaysian public university in 1999 as Universiti Teknologi MARA ("Universiti Teknologi MARA," 2013). The programme was developed by the Faculty of Applied Sciences by given programme code namely AS119/ SC119 with no special streaming. In the year of 2000-2002, AS119 underwent curriculum review process. As a result from the review, AS119 was upgraded to AS120 with two streaming, biological and physical (H. Kassim, personal communication, August 20, 2013). Ever since the programme was established, this programme was only offered to bumiputeras Sijil Pelajaran Malaysia (SPM) holders. To date, AS120 are offered at six campuses. They are namely UiTM Terengganu at Chendering Campus, UiTM Sabah at Kota Kinabalu Campus, UiTM Perlis at Arau Campus, UiTM Negeri Sembilan at Beting Campus, UiTM Sarawak at Samarahan Campus and UiTM Pahang at Jengka Campus. A few university-college franchises also offered AS120, based on mutual agreement with the UiTM and Ministry of Higher Education (MOHE). At Universiti Teknologi MARA Pahang (UiTMP), the growing number of students of AS120 had at one time reached more than 200 with a total of 1000 of them on campus. Currently, it is also estimated that the total numbers of graduates from AS119 and AS120 are more than 10 000 students (H. Kassim, personal communication, August 20, 2013).

In the years of 2008-2010, another curriculum review was done for AS120. In this new curriculum design, Outcome Based Education (OBE) was implemented in the programme as it was required by MOHE. As the review considered the stake holders' point of view and marketability of the graduates, the programme module offered a fresh streaming, namely, academic and career. The students are given options to choose their streaming before the admission of their third year, based on the academic performance. If a student gets Cumulative Grade Point Average (CGPA) less than 2.5, it is compulsory for the students to choose the career streaming, while higher grade students (CGPA 2.5 and above) can choose their streaming based on their interest (M.S Musa, personal communication, August 20, 2013). The career streaming was developed

to provide more competency and experience for working in the related field. Hence, this streaming needs excellent rapport with other faculties that offered different courses in order to suit with the objectives and outcomes of each module. In contrast for academic streaming, this streaming preparing the students to engage higher level of study, for an example, degree in biology at the same faculty or other related programmes offered by other faculties. On the management perspective, this new streaming is a matter challenge, as the career coursing offered more subjects, hence the time tabling and class allocation for the subject will set more complicated.

Currently for AS120, there are four programme educational objectives (PEO) as shown in Table 1 (AS120 Program Details, 2010). These objectives must be achieved by the graduates once they complete the programme. In order to achieve the programme objectives, the entire courses offered throughout the studying period must accomplish the programme outcomes (PO). AS120 has 11 programme outcomes to be achieved as given in Table 2 (AS120 Program Details, 2010). About 80 % of the courses in this programme do addressing the first programme outcome (PO 1) which is the student should be able to acquire and apply knowledge of mathematics and science fundamentals. In contrast, courses that offered to accomplish programme outcomes with the lowest percentage, 8.6 %, is PO 10 which is the student should be able to acquire and apply managerial and entrepreneurial skills.

Table 1: Programme Educational Objectives for Diploma in Science (AS120)

PEO No.	Programme Educational Objectives Description
PEO 1	Semi-professionals in applied sciences who analyse and apply the knowledge, understanding and laboratory experiences to provide quality products and services to the government agencies and science industries
PEO 2	Semi-professionals in applied sciences that lead and engage in teams in problem solving tasks across disciplines through effective communicative abilities.
PEO 3	Semi-professionals in applied sciences who continue to advance their knowledge and abilities by utilizing ICT to explore business opportunities in the science-related industry.
PEO 4	Semi-professionals in applied sciences that practice ethical and professional values in providing services to the recipients and provider of the science-related industry.

Table 2: Programme Outcomes for Diploma in Science (AS120)

PO No.	Programme Outcomes Description
PO 1	Able to acquire and apply knowledge of mathematics and science fundamentals.
PO 2	Able to safely use the techniques, skills and modern scientific tools necessary for science practices.
PO 3	Able to conduct experiments; analyse and interpret experimental data.
PO 4	Able to identify and solve science related problems.
PO 5	Able to verbally communicate scientific ideas effectively.
PO 6	Able to communicate scientific ideas effectively in written form.
PO 7	Able to effectively work in a team in science projects.
PO 8	Able to recognize and apply ethical standards and professionalism in their professional work.
PO 9	Able to manage information and engage in life-long learning.
PO 10	Able to acquire and apply managerial and entrepreneurial skills.
PO 11	Able to demonstrate leadership skills.

As this module is formulated under OBE, the learning assessment was documented and practised accordingly. Besides, to achieve standardization between the lecturers, they are provided with guided rubrics. Some of the assessments are more objective than others. As documentation and achievement in the assessment can be measured and compared, hence this paper will discuss on students' insight on their performance compared to the PEO suggested by the programme itself. Due to assessment measurability, the cognitive domain is easier and fair rather than the assessment of psychomotor and affective domain. Therefore, this paper will discuss more on the cognitive assessment achieved by the respondents. The psychomotor and affective domains are also important but more subjective and appealing to lifelong learning affect.

Methodology

In this study, we have come out with a questionnaire and the respondents were the first and second cohort of OBE graduating AS120, the Diploma in Science students. A total of 74 students were sampled in the second semester of December 2012 – April 2013 and the distributions of sampling were shown in Table 1. In addition to the questionnaire, a submission of biology test paper was reviewed in detail to compare the students' cognitive performance as they perceived in the questionnaire. The questionnaire consists of ten straightforward questions and the respondents may ask if they were uncertain of the questions.

Table 1 Distribution of sampling respondents.

Graduating Cohort	Total	Sampled	Percentage of questionnaire sampled	Percentage of test paper reviewed
Part 6	90	30	33.33%	Not included
Part 5	44	44	100%	31.8%

Result and Discussion

In the simple meaning of OBE, the graduates should reflect the learning outcomes that they have spent in the academic years. The learning outcomes are mostly from the programme they were engaged and other co-curricular activities. Besides the university and faculty compulsory elements, the MOHE also highlighted that some soft skills or *kemahiran isaniah* must be part of the OBE graduates. Hence, the programme curriculum was designed and prepared in such detail to ensure these elements were put in place. There are three domains that are emphasised by the higher level education which are cognitive, psychomotor and affective domains. Each domain has levels that need to be achieved by the students. Cognitive domains are the ability to achieve specific knowledge and skills and can be measured mostly by written assessment. Psychomotor domains involve physical movement, coordination, and use of the motor-skills areas where it requires practice and is measured in terms of speed, precision, distance, procedures or techniques. Affective domains are more about the impact of college experiences towards students' values, goals, attitudes, self-concepts, worldviews, and behaviours (Mohd Ghazali Mohayidin, 2008). In some students' suggestion and review, they loved having physical activities such as laboratory practices and academic trips more than just having lectures in the classroom.

Cognitive Domain

Bloom's Taxonomy provided carefully developed definitions for each of the six major levels in the cognitive domain. The levels are Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation, respectively (Krathwohl, 2002). Figure 1 shows the comparison of cognitive achievement of students from the first and second cohort of OBE with cognitive domain level in the AS120 programme. Students of both cohorts achieved five levels of cognitive domain level except for level 5 and level 2 for the first and second cohort respectively. The highest achievement percentage was 40% and 35.71% of level 3 or application was achieved by the first and second cohort respectively. In comparison with the programme outcomes, the highest achievement level should be in level 1 and 2 with 71% and non-achievable is level 6. Most of the students agreed with level 3 due to all the knowledge gained in class were applicable during tests, quizzes, and examinations. As discussed by Watering and Rijt (2006), the excellent students showed that they underestimate their performance while the teachers overestimated the easy level and underestimate the difficulty level of an assessment in higher education. In AS120, the set of cognitive level was more suited to diploma level as the higher thinking orders only need to show some easy and moderate complexity, compared to the lower thinking orders. All PEOs of AS120 display the cognitive level of at least at the first level, which is knowledge. When the students perform greater activity, such as problem solving in PEO 2 at application and analysis level, the fundamental of knowledge should be available to support the task.

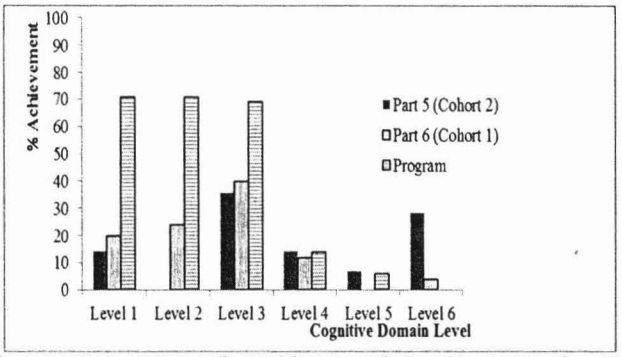

Figure 1: Achievement percentage of cognitive domain level by graduating AS120 students.

Psychomotor Domain

Some activities and subjects such as laboratory science subjects, health sciences, art, music, engineering, drama, physical education and sport sciences use psychomotor domain and this domain mainly emphasises physical skills involving co-ordination of the brain and muscular activity (Liljana et al., 2012). There are seven levels in the psychomotor domain which are perception, set, guided response, mechanism, complex overt response, adaptation and origination. Figure 2 shows the psychomotor achievement of student from the first and second cohort of OBE in AS120 programme. All levels of psychomotor domain have been achieved by the second cohort OBE students while only five levels were achieved by the first cohort OBE students. The highest percentage achievement for the first and second cohort is level 2 and level 7 with 56 % and 42.86 %, respectively. In comparison with programme effective domain level the highest achievement should be in level 1 and 2 and the level that should be non-achievable in the programme are level 6 and 7. The results may vary in each cohort of OBE students based on their ability to respond in certain situations and they also did not have enough understanding on psychomotor domain level in term of measurement and achievement. This was based on their verbalised feedback while having the survey session.

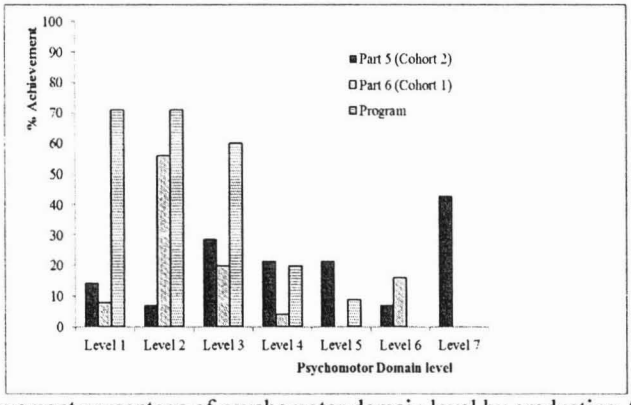

Figure 2: Achievement percentage of psychomotor domain level by graduating AS120 students.

Affective Domain

The emotional component is related to the learning and willingness to receive information on beliefs, values, ideas and attitudes are concerned with the affective domain. Examples of affective domain achievement are when students were able to display professional commitment in ethical practices and personal belief (Liljana *et al.*, 2012). Comparison of achievement in affective domain by graduating OBE students with programme outcomes is shown in Figure 3. The highest percentage achievement for first and second cohort OBE students are level 3 and level 4 with 42.86% and 48 %, respectively. The lowest level achievement is level 5 agreed by first cohort OBE students with programme achievement meanwhile for second cohort of OBE students level 2 is the lowest percentage of achievement.

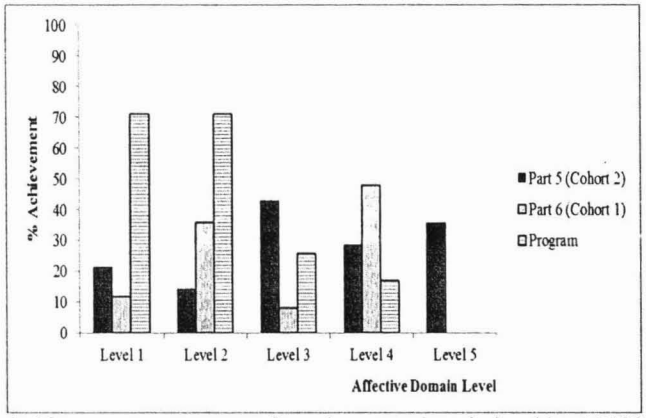

Figure 3: Achievement percentage of psychomotor domain level by AS120 students.

Review on cognitive and complexity level in a biology test paper

For the sampled cognitive performance in the biology test paper, the cognitive and complexity levels were first determined and further sorted to the final analysis. In the test paper, only level 1 to level 4 was covered with three complexity levels; easy, moderate and hard respectively. In the cognitive domain, the levels in higher thinking orders are namely knowledge, comprehension, application, analysis, synthesis and evaluation. The analysis shows only 51.67% has passed, showing about 48.33% has failed in the average marks. As describe by Figure 4, this finding was found contradictory with the level perceived by the respondent. Most of the students appear to have higher thinking orders but in the real situation only half of them achieved the target. The best performance was at 78.7% gained and only 21.3% lost, while the worst performance was at 23.4% and 76.6% of gained and lost, respectively. In Figure 4, the lower thinking order with lower complexity was found better result compared to the moderate and hard complexity level. As displayed by Figure 5, the graph shows the percentage of part 5 students' perception on their achievement in cognitive level. Based on Figure 4 and 5, higher percentage of cognitive domains are actually gained by the students in level 1 to 2 while the students' perception is higher for level 3 and 4 as compared to the biology test paper. In spite of the perception showing a bit contradictory with actual result, the students were only reflecting the highest level that they have apparently gained at the time of responding. We believe the students whom were the respondents need clear justification and understanding prior to answer the questionnaire.

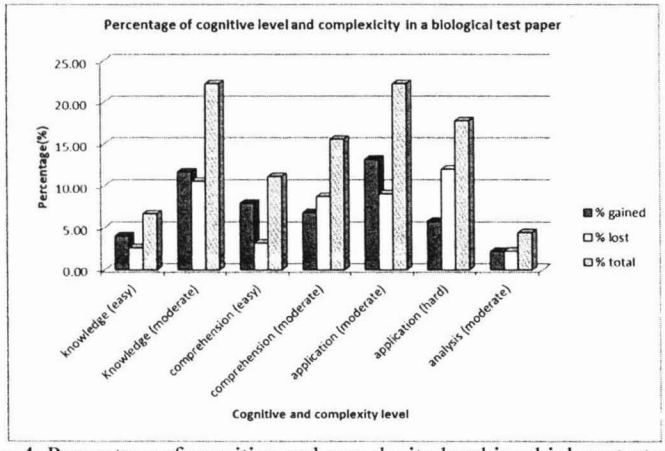

Figure 4: Percentage of cognitive and complexity level in a biology test paper.

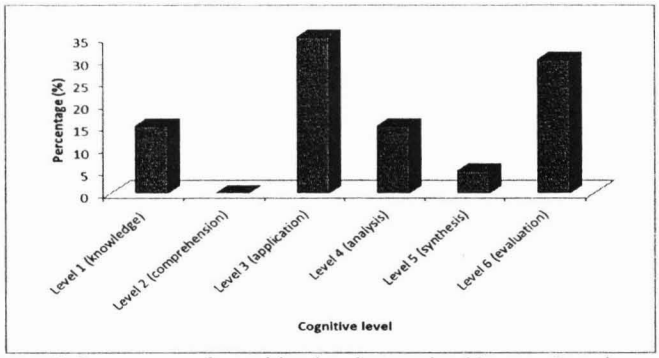

Figure 5: Percentage of cognitive levels perceived by part 5 students.

Conclusion

The Diploma in Science has been established in UiTM for quite some time. Many of the AS119/AS120 alumni have shown to serve the country as various professional and experts, especially in the science and technology field. Hence these alumni reflect the effectiveness and outcomes of the curriculum design engaged by the current students. Due to the OBE and the challenges of the millennium years, competencies of graduates are the highlight in formulating curriculum for a programme. Beyond cognitive domain, the two other domains, psychomotor and affective respectively are also important in producing excellent and holistic graduates. The outcome of this paper shows students were undergoing OBE process even though the exact and depth knowledge of this system is not well understood. The students were also found to be overestimating their achievement compared to the actual result from the biology test paper. We suggest that more depth measurement on the graduate's achievement domains should be acknowledged in order to formulate new and better curriculum design.

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