

Assessing Higher Education for Architecture, Engineering and Surveying

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Key words : Quality education, paradigm shift, academic performance, Outcomes Based Teaching and Learning.

SUMMARY

This research aims at exploring the empirical relationship of students' academic performance with the curricula design, program/course intended learning outcomes, delivery mode, teaching & learning activities and assessment strategies under the "Outcomes Based Teaching and Learning" (OBTL) methodology, for various undergraduate programs related to architectural studies, building services engineering, construction engineering, building surveying, estate surveying and quantity surveying of a Hong Kong university. Quantitative data (in terms of students' Cumulative Grade Point Average (CGPA) reflecting their performance in examination, coursework, projects and various assessments) are analysed to compare the respective students' academic performance in each program/cohort, and investigate how their performances would be affected by the above OBTL methodology and the variances among each program/cohort. Reliability test, students' t test, and ANOVA statistical techniques will be adopted. From the research, it is expected to help improve overall teaching and learning quality, primarily with a carefully designed curriculum at the outset, including that of intended learning outcomes, pre-defined teaching & learning activities and solid assessment strategies, for enhancing any students of the construction-related undergraduate programs.

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1. BACKGROUND

Reilly (2011) and Ewell (2011) advocate that the use of outcomes based approaches is now worldwide and their salience is growing at both the institutional and national levels in designing curriculum and teaching approaches, and in helping to determine their effectiveness. The local higher education sector has been moving towards a paradigm shift for more *result-oriented* teaching and learning, through Outcomes Based Teaching and Learning (OBTL) approach (HKSAR UGC, 2011). This OBTL methodology and its practices have been adopted in overseas institutions for some time, whilst touch base in Hong Kong for few years. In following this trend and achieving this target, most local institutions have been modifying its programmes, courses, modules and subjects to suit, and thus the effectiveness of the captioned programmes will be reflected by the outcome i.e. students' academic performance – a valid indicator of students' competence. Hence, the respective programmes' details are examined as follows.

1.1 Architectural Studies Programme

Pang et al. (2009) and Fletcher (2008) contend that OBTL is strongly linked with accreditation which means public recognition that an educational institution or educational programme has met certain standards or criteria. This program has adopted a problem-based learning approach in students' learning and teaching. The program consists of Studio Projects, Problem Cases, Lectures, Seminars, Skills Workshops, Practical Training, and co-curricular activities that are fully integrated into the curriculum. Coursework is the main assessment task of the program and provides a medium through which students' understanding of the interrelated aspects of building design, production and performance can be developed and evaluated (BST, 2011). The program aims to produce graduates who possess:

- Content-based knowledge and practical skills related to architectural professionals to enable them to work as a competent associate professional in the architectural and building industry; and
- Intellectual abilities and transferable skills to communicate effectively, analyze information critically, solve problems independently, through acquiring generic skills for language, IT, interpersonal, teamwork, self-management and life-long learning.

The graduates are expected to have a broad-based academic foundation and practical skills in architectural studies to enter into an international workplace or continuing education in local and overseas universities.

1.2 Building Services Engineering Programme

Griffin (2008) points out that (1) too many policymakers and educational leaders are focused on...tests rather than on what is really important: whether students are learning what they need to know; (2) assessment is not about evaluating teaching...it is about evaluating learning; and (3) assessment efforts should be concentrated in “soft skills” also. This program is constituted from a range of courses which combine formal lectures, tutorials, laboratories, workshops and practical courseworks. It is stressed that coursework is an important feature of some courses and provides a medium through which students’ understanding of the interrelated aspects of building services design, production and performance can be developed and assessed (BST, 2011). The programme aims to produce graduates to possess:

- Content-based knowledge and practical skills related to building services engineering professionals to enable them to work as a competent associate professional in the construction and real estate industry; and
- Intellectual abilities and transferable skills to communicate effectively, analyze information critically, solve problems independently, through acquiring generic skills for language, IT, interpersonal, teamwork, self-management and life-long learning.

The graduates are expected to have a broad-based academic foundation and practical skills in building services engineering to enter into an international workplace or continuing education in local and overseas universities.

1.3 Construction Engineering & Mgt. Programme

Schochet (2011) and Saunders (2008) state that a student outcomes approach demands the institutions to enable and recognise achievement, but there is a kind of politics in all such recognition. The outcome is a dialogue that has to feed back into the curriculum. This programme consists of a range of courses which combine formal lectures, tutorials, studios, seminars, workshops, demonstrations and practical courseworks. It is stressed that coursework is an important feature of some courses and provides a medium through which the students’ understanding of the interrelated aspects of building design, production and performance can be developed and assessed (BST, 2011). The programme aims to produce graduates with:

- Comprehensive knowledge and practical professional skills required to work as a competent associate professional in construction engineering and management; and
- Intellectual abilities and transferable skills to communicate effectively, analyze information critically, solve problems independently, through acquiring generic skills for language, IT, interpersonal, teamwork, self-management and life-long learning.

Graduates are expected to have a broad-based academic foundation and practical skills in construction engineering and management to enter into an international workplace or to continue

education in local and overseas universities.

1.4 Surveying Programme (Building Surveying/Estate Surveying/Quantity Surveying)

Angelo (2008) opines that in order to better promote high-quality and deep learning, institutions have to develop (1) meaningful, measurable outcomes; (2) shared, transparent standards for learning; and (3) effective and efficient assessment, feedback for learning, and curriculum designs. This programme consists of a range of courses which combine formal lectures, tutorials, seminars, site visits, workshops, demonstrations, laboratories, practical coursework and surveying projects. It is stressed that Project work is an important feature of the programme and it provides a medium through which the students are able to acquire and in-depth understanding of the interrelated aspects of property and construction in terms of measurement, valuation, development, building design, construction process, procurement, cost and documentation can be developed and assessed. The surveying project helps student to integrate the various courses learnt through producing drawings and documents to a professionally acceptable standard (BST, 2011).

In addition, the programme aims to produce graduates with comprehensive knowledge and practical professional skills required to work as a competent associate professional in building surveying / estate surveying / quantity surveying; and develop graduates with intellectual abilities and transferable skills required for them to communicate effectively, analyze information critically, solve problems independently, and process IT, interpersonal, leadership, teamwork, self-management and life-long learning skills. Graduates are expected to have a broad-based academic foundation and practical skills in surveying to enter into an international workplace or to continue education in local and overseas universities.

With the foregoing details, the architectural studies programme is closer to Problem Based Learning (PBL) approach in delivery, where teachers and students will have higher degree of interaction, whilst less structured lecturing when compared with other programmes. This delivery mode may be said to be more in line with the OBTL approach. Interviews are conducted to recruit the most suitable applicants i.e. with some design flair prior to admission. These students have high scores (when compared with other programs) in open secondary examination before joining the programme (Rank 2 out of 4).

The building services engineering programme is traditional inclined to have more scientific and mathematical content, where students could attain concrete marks when couseworks/assessments are done correctly. Given an OBTL approach with definite curriculum design, their performance must be good. These students have moderate scores (when compared with other programmes) in open secondary examination before joining the programme (Rank 3 out of 4).

The construction engineering programme is having engineering, technological and management content, whilst students must have studied science subjects beforehand at secondary school level,

i.e. non-science students would not be accepted. Traditionally, science students may find difficulties in learning management subjects. These students have lowest scores (when compared with other programs) in open secondary examination before joining the programme (Rank 4 out of 4).

The surveying programme is in majority having technological, management and non-engineering content, whilst recruitment is open to all science, commerce and arts students. Similarly, in tradition, science students may find difficulties in learning management/arts subjects, while commerce/arts students may find difficulties in learning some technological subjects. However, the programme is designed to split equally the students to study building surveying (more technology/management based), real estate surveying (more management/arts based), and quantity surveying (more technology/calculation based), with appropriate mapping of their previous studies. These students have highest scores (when compared with other programmes) in open secondary examination before joining the programme (Rank 1 out of 4).

2. METHODOLOGY

Students' academic performance, i.e. CGPA of different cohort for the captioned programmes are analysed by means of the statistical software, primarily ANOVA (one-way between-groups, with post-hoc comparisons) to compare their respective CGPA means so as to know more about the students' respective performances.

3. FINDINGS AND ANALYSIS

After performing the statistical analysis (Appendix Tables 1a to 1d), the findings and results are revealed as below.

Programme 1 has significantly different CGPA means with programme 3,4,5,6 at $P < .05$
Programme 2 has significantly different CGPA means with programme 4 at $P < .05$
Programme 1 has no significantly different CGPA means with programme 2 at $P > .05$
Programme 2 has no significantly different CGPA means with programme 3,5,6 at $P > .05$
Programme 3 has no significantly different CGPA means with programme 4,5,6 at $P > .05$
Programme 4 has no significantly different CGPA means with programme 5,6 at $P > .05$
Programme 5 has no significantly different CGPA means with programme 6 at $P > .05$

The statistical analysis as shown in Tables 2a to 2d reveal the followings:

Programme 1 has significantly different CGPA means with programme 3,4 at $P < .05$
Programme 2 has significantly different CGPA means with programme 3,4 at $P < .05$
Programme 4 has significantly different CGPA means with programme 6 at $P < .05$
Programme 1 has no significantly different CGPA means with programme 2,5,6 at $P > .05$
Programme 2 has no significantly different CGPA means with programme 5,6 at $P > .05$

Programme 3 has no significantly different CGPA means with programme 4,5,6 at $P > .05$
Programme 4 has no significantly different CGPA means with programme 5 at $P > .05$
Programme 5 has no significantly different CGPA means with programme 6 at $P > .05$

The statistical analysis as shown in Tables 3a to 3d reveal the followings:

Programme 1 has significantly different CGPA means with programme 3 at $P < .05$
Programme 2 has significantly different CGPA means with programme 3 at $P < .05$
Programme 1 has no significantly different CGPA means with programme 2 at $P > .05$

The statistical analysis as shown in Tables 4a to 4d reveal the followings:

Programme 1 has significantly different CGPA means with programme 3 at $P < .05$
Programme 2 has significantly different CGPA means with programme 3,4 at $P < .05$
Programme 3 has significantly different CGPA means with programme 5 at $P < .05$
Programme 1 has no significantly different CGPA means with programme 2,4,5 at $P > .05$
Programme 2 has no significantly different CGPA means with programme 5 at $P > .05$
Programme 3 has no significantly different CGPA means with programme 4 at $P > .05$
Programme 4 has no significantly different CGPA means with programme 5 at $P > .05$
Programme 5 has no significantly different CGPA means with programme 6 at $P > .05$

Key:

Programme 1 represents Architectural Studies
Programme 2 represents Building Services Engineering
Programme 3 represents Construction Engineering/Management
Programme 4 represents Building Surveying
Programme 5 represents Estate Surveying
Programme 6 represents Quantity Surveying

3.1 Observation 1

08 cohort Year 2 Semester A 09/10 CGPA results

Programme 1 has significantly different CGPA means with programme 3,4,5,6 at $P < .05$
Programme 2 has significantly different CGPA means with programme 4 at $P < .05$

08 cohort Year 2 Semester B 09/10 CGPA results

Programme 1 has significantly different CGPA means with programme 3,4 at $P < .05$
Programme 2 has significantly different CGPA means with programme 3,4 at $P < .05$
Programme 4 has significantly different CGPA means with programme 6 at $P < .05$

09 cohort Year 1 Semester A 09/10 CGPA results

Programme 1 has significantly different CGPA means with programme 3 at $P < .05$
Programme 2 has significantly different CGPA means with programme 3 at $P < .05$

09 cohort Year 1 Semester B 09/2010 CGPA results

Programme 1 has significantly different CGPA means with programme 3 at $P < .05$
Programme 2 has significantly different CGPA means with programme 3,4 at $P < .05$
Programme 3 has significantly different CGPA means with programme 5 at $P < .05$

It can be stated that Programme 1 is consistently having significant (higher or better) mean difference over Programme 3 in the 4 semesters; while higher or better than Programme 4 in 2 semesters. It may mean that Programme 3 and 4 are more difficult or Programme 1 is easier to study, or curriculum is better designed to cope with the students. Alternatively, it may imply that students of Programme 1 have higher study ability, while students of Programme 3 and 4 have lesser study ability. In addition, it may argue that the teachers have taught well, yet it may not be easy to prove scientifically.

It can be stated that Programme 2 is consistently having significant (higher or better) mean difference over Programme 3 and 4 in the 3 semesters. It may mean that Programme 3 and 4 are more difficult or Programme 2 is easier to study, or the curriculum can cope with the students' background. Alternatively, it may imply that students of Programme 2 have higher study ability, while students of Programme 3 and 4 have lesser study ability. In addition, it may argue that the teachers have taught well, yet it may not be easy to prove scientifically.

3.2 Observation 2

08 cohort Year 2 Semester A 09/10 CGPA results

Programme 1 has no significantly different CGPA means with programme 2 at $P > .05$
Programme 2 has no significantly different CGPA means with programme 3,5,6 at $P > .05$
Programme 3 has no significantly different CGPA means with programme 4,5,6 at $P > .05$
Programme 4 has no significantly different CGPA means with programme 5,6 at $P > .05$
Programme 5 has no significantly different CGPA means with programme 6 at $P > .05$

08 cohort Year 2 Semester B 09/10 CGPA results

Programme 1 has no significantly different CGPA means with programme 2,5,6 at $P > .05$
Programme 2 has no significantly different CGPA means with programme 5,6 at $P > .05$
Programme 3 has no significantly different CGPA means with programme 4,5,6 at $P > .05$
Programme 4 has no significantly different CGPA means with programme 5 at $P > .05$
Programme 5 has no significantly different CGPA means with programme 6 at $P > .05$

09 cohort Year 1 Semester A 09/10 CGPA results

Programme 1 has no significantly different CGPA means with programme 2 at $P > .05$

09 cohort Year 1 Semester B 09/10 CGPA results

Programme 1 has no significantly different CGPA means with programme 2,4,5 at $P > .05$
Programme 2 has no significantly different CGPA means with programme 5 at $P > .05$
Programme 3 has no significantly different CGPA means with programme 4 at $P > .05$

Programme 4 has no significantly different CGPA means with programme 5 at $P > .05$
Programme 5 has no significantly different CGPA means with programme 6 at $P > .05$

It can be stated that Programme 1 is consistently having no significant (higher or better) mean difference over Programme 2 in the 4 semesters; while over Programme 5 in 2 semesters. It may mean that Programme 1 and 2 are of similar standing and/or easiness to study. Perhaps the curriculum is properly designed and mapped with the students. Alternatively, it may imply that students of Programme 1 and 2 have similar and/or higher study ability. In addition, it may argue that the teachers have taught well, yet it may not be easy to prove scientifically.

It can be stated that Programme 2 is consistently having no significant (higher or better) mean difference over Programme 5 in the 3 semesters; while over Programme 6 in 2 semesters. It may mean that Programme 2 and 5 are of similar standing and/or easiness to study, but it does not imply that Programme 1 and 5 are of similar standing. Alternatively, it may mean that students of Programme 2 and 5 have similar and/or high study ability.

It can be stated that Programme 3 is consistently having no significant (higher or better) mean difference over Programme 4 in the 3 semesters; while over Programme 5 and 6 in 2 semesters. It may mean that Programme 3 and 4 are of similar standing and/or difficulty to study. Alternatively, it may imply that students of Programme 3 and 4 have similar and/or lower study ability. It can be stated that Programme 4 is consistently having no significant (higher or better) mean difference over Programme 5 in the 3 semesters. It may mean that Programme 4 and 5 are of similar standing and/or difficulty to study. Alternatively, it may imply that students of Programme 4 and 5 have similar and/or lower study ability.

It can be stated that Programme 5 is consistently having no significant (higher or better) mean difference over Programme 6 in the 3 semesters. It may mean that Programme 5 and 6 are of similar standing and/or difficulty to study. Alternatively, it may imply that students of Programme 5 and 6 have similar and/or lower study ability. Yet, this contradicts with “Programme 2 and 5 are of similar standing and/or easiness to study. Alternatively, it may imply that students of Programme 2 and 5 have similar and/or high study ability”. As a reconciliation from the means obtained, it may be stated that Programme 2 is easier to study than Programme 5 and 6 or alternatively, students of Programme 2 have higher study ability than that of Programme 5 and 6.

Additional analysis is done for Year 1 and 2 students in 2 semesters under the 4 programmes for further verifications. The statistical results as shown in Tables 4a to 4d and Tables 5a to 5d bring forth the following observations.

3.3 Observation 3

Programme 1 has significantly different CGPA means with programme 2,3,4 at $P < .05$

Programme 2 has significantly different CGPA means with programme 3 at $P < .05$

Programme 2 has no significantly different CGPA means with programme 4 at $P > .05$

Key:

Programme 1 represents Architectural studies

Programme 2 represents Building Services Engineering

Programme 3 represents Construction Engineering & Mgt.

Programme 4 represents Surveying (encompass Building Surveying, Estate Surveying, and Quantity Surveying hereof)

It can be stated that Programme 1 is consistently having significant (higher or better) mean difference over Programme 2, 3, 4 in these two semesters. It may mean that Programme 2, 3 and 4 are more difficult or Programme 1 is easier to study, or curriculum is better designed to cope with the students. Alternatively, it may imply that students of Programme 1 have higher study ability, while students of Programme 2, 3 and 4 have lesser study ability. In addition, it may argue that the teachers have taught well, yet it may not be easy to prove scientifically.

It can be stated that Programme 2 is consistently having significant (higher or better) mean difference over Programme 3 in these two semesters. It may mean that Programme 3 is more difficult or Programme 2 is easier to study, or the curriculum can cope with the students' background. Alternatively, it may imply that students of Programme 2 have higher study ability, while students of Programme 3 have lesser study ability. In addition, it may argue that the teachers have taught well, yet it may not be easy to prove scientifically.

It can be stated that Programme 2 is consistently having no significant (higher or better) mean difference over Programme 4 in these two semester. It may mean that Programme 2 and 4 are of similar standing and/or easiness to study. Perhaps the curriculum is properly designed and mapped with the students. Alternatively, it may imply that students of Programme 2 and 4 have similar and/or higher study ability. In addition, it may argue that the teachers have taught well, yet it may not be easy to prove scientifically.

4. CONCLUSION

Programme 1 (Architectural Studies) students' performance is the highest (Rank 1 out of 4) among all programmes. It may be that the programme has largely adopted problem-based learning, more project based approach, innovative thinking, substantial extra curriculum & co-curriculum activities, no examinations and ample interaction with teachers. Programme 2 (Building Services Engineering) students' performance is the second highest (Rank 2 out of 4). The programme is principally focused on engineering and mathematics; with many structured teaching & examinations, course based works, supplemental instructions, and a final year project. Programme 4 (Surveying) students' performance is the third highest (Rank 3 out of 4). The programme's nature encompasses primarily arts, commerce and few science/mathematics subjects; with many structured teaching & examinations, whilst not following problem based learning approach. Extra curriculum & co-curriculum activities appear not too much either. Programme 3 (Construction Engineering & Management) students' performance is ranked 4 out of 4. This programme is basically composed of largely technology, management and

engineering subjects, delivered through many structured teaching & examinations, and supported by many technical/site visits. However, the students' admission scores are the lowest among the 4 programmes. From the forgoing discussions, it may be concluded that students' learning and academic performance are primarily linked up with the curriculum design, mode of delivery, teaching & learning activities and assessment strategies as stipulated under the OBTL methodology whilst subject to some other extraneous variables e.g. teachers' ability/performance, level of respective programmes' difficulties, differences in associated teaching/learning activities, degree of extra curriculum & co-curriculum activities, extent of out-of-class activities, students' admission scores etc. yet to be studied further.

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Appendixes

Table 1 - 08 cohort Year 2 Semester A 09/10 CGPA results

Table 1a Descriptives
VAR00002

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------|-----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| 1.00 | 75 | 3.1415 | .29933 | .03456 | 3.0726 | 3.2103 | 2.31 | 3.85 |
| 2.00 | 55 | 2.9518 | .41264 | .05564 | 2.8403 | 3.0634 | 1.78 | 3.70 |
| 3.00 | 72 | 2.8007 | .47933 | .05649 | 2.6881 | 2.9133 | 1.26 | 3.57 |
| 4.00 | 45 | 2.6853 | .51981 | .07749 | 2.5292 | 2.8415 | .98 | 3.83 |
| 5.00 | 52 | 2.9054 | .36657 | .05083 | 2.8033 | 3.0074 | 2.05 | 3.81 |
| 6.00 | 48 | 2.9029 | .36080 | .05208 | 2.7982 | 3.0077 | 2.19 | 3.64 |
| Total | 347 | 2.9132 | .43090 | .02313 | 2.8677 | 2.9587 | .98 | 3.85 |

Table 1b Test of Homogeneity of Variances

VAR00002

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 3.381 | 5 | 341 | .005 |

Table 1c ANOVA

VAR00002

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|-------|------|
| Between Groups | 7.246 | 5 | 1.449 | 8.670 | .000 |
| Within Groups | 56.998 | 341 | .167 | | |
| Total | 64.244 | 346 | | | |

Table 1d Multiple Comparisons

VAR00002

Tukey HSD

| (I) VAR00001 | (J) VAR00001 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--------------|--------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | .18965 | .07258 | .097 | -.0184 | .3977 |
| | 3.00 | .34077* | .06746 | .000 | .1474 | .5341 |
| | 4.00 | .45613* | .07709 | .000 | .2352 | .6771 |
| | 5.00 | .23608* | .07378 | .019 | .0246 | .4475 |
| | 6.00 | .23855* | .07557 | .021 | .0220 | .4551 |
| 2.00 | 1.00 | -.18965 | .07258 | .097 | -.3977 | .0184 |
| | 3.00 | .15112 | .07322 | .309 | -.0587 | .3610 |
| | 4.00 | .26648* | .08218 | .016 | .0310 | .5020 |
| | 5.00 | .04643 | .07908 | .992 | -.1802 | .2731 |
| 3.00 | 1.00 | -.34077* | .06746 | .000 | -.5341 | -.1474 |
| | 2.00 | -.15112 | .07322 | .309 | -.3610 | .0587 |
| | 4.00 | .11536 | .07769 | .674 | -.1073 | .3380 |
| | 5.00 | -.10469 | .07440 | .723 | -.3179 | .1086 |
| 4.00 | 1.00 | -.45613* | .07709 | .000 | -.6771 | -.2352 |
| | 2.00 | -.26648* | .08218 | .016 | -.5020 | -.0310 |
| | 3.00 | -.11536 | .07769 | .674 | -.3380 | .1073 |
| | 5.00 | -.22005 | .08324 | .090 | -.4586 | .0185 |
| 5.00 | 1.00 | -.23608* | .07378 | .019 | -.4475 | -.0246 |
| | 2.00 | -.04643 | .07908 | .992 | -.2731 | .1802 |
| | 3.00 | .10469 | .07440 | .723 | -.1086 | .3179 |
| | 4.00 | .22005 | .08324 | .090 | -.0185 | .4586 |

| | | | | | | |
|------|------|----------|--------|-------|--------|--------|
| | 6.00 | .00247 | .08183 | 1.000 | -.2321 | .2370 |
| 6.00 | 1.00 | -.23855* | .07557 | .021 | -.4551 | -.0220 |
| | 2.00 | -.04890 | .08076 | .991 | -.2803 | .1825 |
| | 3.00 | .10222 | .07618 | .761 | -.1161 | .3206 |
| | 4.00 | .21758 | .08483 | .109 | -.0255 | .4607 |
| | 5.00 | -.00247 | .08183 | 1.000 | -.2370 | .2321 |

Key:

- 1.00 represents Architectural studies programme
- 2.00 represents Building Services Engineering programme
- 3.00 represents Construction Engineering/Management programme
- 4.00 represents Building Surveying programme
- 5.00 represents Estate Surveying programme
- 6.00 represents Quantity Surveying programme

Table 2 - 08 cohort Year 2 Semester B 09/2010 CGPA results

Table 2a Descriptives

VAR00006

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------|-----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| 1.00 | 78 | 3.1058 | .37160 | .04208 | 3.0220 | 3.1896 | 1.64 | 3.85 |
| 2.00 | 51 | 3.1100 | .32815 | .04595 | 3.0177 | 3.2023 | 2.48 | 3.76 |
| 3.00 | 71 | 2.8601 | .44277 | .05255 | 2.7553 | 2.9649 | 1.50 | 3.64 |
| 4.00 | 44 | 2.7880 | .45479 | .06856 | 2.6497 | 2.9262 | 1.54 | 3.90 |
| 5.00 | 50 | 2.9940 | .31835 | .04502 | 2.9035 | 3.0845 | 2.39 | 3.74 |
| 6.00 | 48 | 3.0260 | .33639 | .04855 | 2.9284 | 3.1237 | 2.32 | 3.76 |
| Total | 342 | 2.9870 | .39702 | .02147 | 2.9448 | 3.0292 | 1.50 | 3.90 |

Table 2b Test of Homogeneity of Variances

VAR00006

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 2.224 | 5 | 336 | .052 |

Table 2c ANOVA

VAR00006

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|-------|------|
| Between Groups | 4.833 | 5 | .967 | 6.640 | .000 |
| Within Groups | 48.918 | 336 | .146 | | |
| Total | 53.751 | 341 | | | |

Table 2d Multiple Comparisons

VAR00006

Tukey HSD

| (I) VAR00005 | (J) VAR00005 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--------------|--------------|-----------------------|------------|-------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | -.00423 | .06871 | 1.000 | -.2012 | .1927 |
| | 3.00 | .24563* | .06259 | .001 | .0662 | .4250 |
| | 4.00 | .31781* | .07194 | .000 | .1116 | .5240 |
| | 5.00 | .11177 | .06913 | .588 | -.0864 | .3099 |
| | 6.00 | .07973 | .07000 | .865 | -.1209 | .2804 |
| 2.00 | 1.00 | .00423 | .06871 | 1.000 | -.1927 | .2012 |
| | 3.00 | .24986* | .07004 | .005 | .0491 | .4506 |
| | 4.00 | .32205* | .07851 | .001 | .0970 | .5471 |
| | 5.00 | .11600 | .07594 | .647 | -.1017 | .3337 |
| 3.00 | 6.00 | .08396 | .07673 | .884 | -.1360 | .3039 |
| | 1.00 | -.24563* | .06259 | .001 | -.4250 | -.0662 |
| | 2.00 | -.24986* | .07004 | .005 | -.4506 | -.0491 |

| | | | | | | |
|------|------|----------|--------|------|--------|--------|
| | 4.00 | .07219 | .07321 | .922 | -.1376 | .2820 |
| | 5.00 | -.13386 | .07044 | .404 | -.3358 | .0681 |
| | 6.00 | -.16590 | .07130 | .186 | -.3703 | .0385 |
| 4.00 | 1.00 | -.31781* | .07194 | .000 | -.5240 | -.1116 |
| | 2.00 | -.32205* | .07851 | .001 | -.5471 | -.0970 |
| | 3.00 | -.07219 | .07321 | .922 | -.2820 | .1376 |
| | 5.00 | -.20605 | .07887 | .097 | -.4321 | .0200 |
| | 6.00 | -.23809* | .07964 | .035 | -.4663 | -.0098 |
| 5.00 | 1.00 | -.11177 | .06913 | .588 | -.3099 | .0864 |
| | 2.00 | -.11600 | .07594 | .647 | -.3337 | .1017 |
| | 3.00 | .13386 | .07044 | .404 | -.0681 | .3358 |
| | 4.00 | .20605 | .07887 | .097 | -.0200 | .4321 |
| | 6.00 | -.03204 | .07710 | .998 | -.2530 | .1890 |
| 6.00 | 1.00 | -.07973 | .07000 | .865 | -.2804 | .1209 |
| | 2.00 | -.08396 | .07673 | .884 | -.3039 | .1360 |
| | 3.00 | .16590 | .07130 | .186 | -.0385 | .3703 |
| | 4.00 | .23809* | .07964 | .035 | .0098 | .4663 |
| | 5.00 | .03204 | .07710 | .998 | -.1890 | .2530 |

Table 3 - 09 cohort Year 1 Semester A 09/10 CGPA results

Table 3a Descriptives
VAR00004

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------|-----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| 1.00 | 98 | 3.0158 | .63033 | .06367 | 2.8894 | 3.1422 | .24 | 4.16 |
| 2.00 | 52 | 3.1612 | .63275 | .08775 | 2.9850 | 3.3373 | .83 | 4.17 |
| 3.00 | 74 | 2.4920 | .73964 | .08598 | 2.3207 | 2.6634 | .47 | 3.49 |
| Total | 224 | 2.8765 | .72108 | .04818 | 2.7816 | 2.9715 | .24 | 4.17 |

Table 3b Test of Homogeneity of Variances
VAR00004

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 3.595 | 2 | 221 | .029 |

Table 3c ANOVA
VAR00004

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|--------|------|
| Between Groups | 17.054 | 2 | 8.527 | 19.055 | .000 |
| Within Groups | 98.895 | 221 | .447 | | |
| Total | 115.949 | 223 | | | |

Table 3d Multiple Comparisons
VAR00004
Tukey HSD

| (I) VAR00003 | (J) VAR00003 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--------------|--------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | -.14534 | .11477 | .416 | -.4161 | .1255 |
| | 3.00 | .52379* | .10302 | .000 | .2807 | .7669 |
| 2.00 | 1.00 | .14534 | .11477 | .416 | -.1255 | .4161 |
| | 3.00 | .66913* | .12105 | .000 | .3835 | .9548 |
| 3.00 | 1.00 | -.52379* | .10302 | .000 | -.7669 | -.2807 |
| | 2.00 | -.66913* | .12105 | .000 | -.9548 | -.3835 |

*. The mean difference is significant at the 0.05 level.

09 cohort Year 1 Semester B 09/10 CGPA results

Descriptives
VAR00008

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------|-----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| 1.00 | 92 | 3.0010 | .55671 | .05804 | 2.8857 | 3.1163 | 1.02 | 4.19 |
| 2.00 | 55 | 3.0695 | .49129 | .06625 | 2.9366 | 3.2023 | 2.03 | 3.92 |
| 3.00 | 66 | 2.6062 | .61465 | .07566 | 2.4551 | 2.7573 | .83 | 3.75 |
| 4.00 | 33 | 2.7391 | .42962 | .07479 | 2.5868 | 2.8914 | 1.78 | 3.55 |
| 5.00 | 37 | 2.9170 | .48337 | .07947 | 2.7559 | 3.0782 | 1.86 | 3.74 |
| Total | 283 | 2.8807 | .56205 | .03341 | 2.8149 | 2.9465 | .83 | 4.19 |

Test of Homogeneity of Variances
VAR00008

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 1.851 | 4 | 278 | .119 |

ANOVA
VAR00008

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|-------|------|
| Between Groups | 8.974 | 4 | 2.243 | 7.785 | .000 |
| Within Groups | 80.111 | 278 | .288 | | |
| Total | 89.085 | 282 | | | |

Multiple Comparisons
VAR00008
Tukey HSD

| (I) VAR00007 | (J) VAR00007 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--------------|--------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | -.06848 | .09150 | .945 | -.3197 | .1828 |
| | 3.00 | .39477* | .08659 | .000 | .1570 | .6325 |
| | 4.00 | .26189 | .10893 | .117 | -.0372 | .5610 |
| | 5.00 | .08395 | .10450 | .929 | -.2030 | .3709 |
| 2.00 | 1.00 | .06848 | .09150 | .945 | -.1828 | .3197 |
| | 3.00 | .46324* | .09801 | .000 | .1941 | .7324 |
| | 4.00 | .33036* | .11820 | .044 | .0058 | .6549 |
| | 5.00 | .15243 | .11414 | .669 | -.1610 | .4658 |
| 3.00 | 1.00 | -.39477* | .08659 | .000 | -.6325 | -.1570 |
| | 2.00 | -.46324* | .09801 | .000 | -.7324 | -.1941 |
| | 4.00 | -.13288 | .11445 | .774 | -.4471 | .1814 |
| | 5.00 | -.31081* | .11025 | .041 | -.6135 | -.0081 |
| 4.00 | 1.00 | -.26189 | .10893 | .117 | -.5610 | .0372 |
| | 2.00 | -.33036* | .11820 | .044 | -.6549 | -.0058 |
| | 3.00 | .13288 | .11445 | .774 | -.1814 | .4471 |
| | 5.00 | -.17794 | .12853 | .638 | -.5309 | .1750 |
| 5.00 | 1.00 | -.08395 | .10450 | .929 | -.3709 | .2030 |
| | 2.00 | -.15243 | .11414 | .669 | -.4658 | .1610 |
| | 3.00 | .31081* | .11025 | .041 | .0081 | .6135 |
| | 4.00 | .17794 | .12853 | .638 | -.1750 | .5309 |

*. The mean difference is significant at the 0.05 level.

Table 4 - 11 cohort (Year 1) Sem. A 11/12 all program CGPA results

Table 4a Descriptives
VAR00002

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|--|---|------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |

| | | | | | | | | |
|-------|-----|--------|---------|--------|--------|--------|-----|------|
| 1.00 | 132 | 3.0506 | .61621 | .05363 | 2.9445 | 3.1567 | .25 | 4.15 |
| 2.00 | 76 | 2.7832 | 1.12909 | .12952 | 2.5252 | 3.0412 | .25 | 4.15 |
| 3.00 | 225 | 2.2939 | .69102 | .04607 | 2.2031 | 2.3847 | .25 | 3.75 |
| 4.00 | 470 | 2.8478 | .53994 | .02491 | 2.7988 | 2.8967 | .25 | 4.15 |
| Total | 903 | 2.7340 | .70799 | .02356 | 2.6877 | 2.7802 | .25 | 4.15 |

Table 4b Test of Homogeneity of Variances
VAR00002

| | | | |
|------------------|-----|-----|------|
| Levene Statistic | df1 | df2 | Sig. |
| 46.398 | 3 | 899 | .000 |

Table 4c ANOVA
VAR00002

| | | | | | |
|----------------|----------------|-----|-------------|--------|------|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 63.080 | 3 | 21.027 | 48.587 | .000 |
| Within Groups | 389.051 | 899 | .433 | | |
| Total | 452.131 | 902 | | | |

Table 4d Multiple Comparisons
VAR00002
Tukey HSD

| (I) VAR00001 | (J) VAR00001 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--------------|--------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | .26734* | .09472 | .025 | .0235 | .5111 |
| | 3.00 | .75668* | .07212 | .000 | .5710 | .9423 |
| | 4.00 | .20278* | .06480 | .010 | .0360 | .3696 |
| 2.00 | 1.00 | -.26734* | .09472 | .025 | -.5111 | -.0235 |
| | 3.00 | .48933* | .08728 | .000 | .2647 | .7140 |
| | 4.00 | -.06456 | .08133 | .857 | -.2739 | .1448 |
| 3.00 | 1.00 | -.75668* | .07212 | .000 | -.9423 | -.5710 |
| | 2.00 | -.48933* | .08728 | .000 | -.7140 | -.2647 |
| | 4.00 | -.55390* | .05333 | .000 | -.6912 | -.4166 |
| 4.00 | 1.00 | -.20278* | .06480 | .010 | -.3696 | -.0360 |
| | 2.00 | .06456 | .08133 | .857 | -.1448 | .2739 |
| | 3.00 | .55390* | .05333 | .000 | .4166 | .6912 |

*. The mean difference is significant at the 0.05 level.

Key:

1.00 represents Architectural studies programme

2.00 represents Building Services Engineering programme

3.00 represents Construction Engineering & Mgt. programme

4.00 represents Surveying programme (encompass Building Surveying, Estate Surveying, and Quantity Surveying hereof)

Table 5 - 11 cohort (Year 1) & 10 cohort (Year 2) Sem. A 11/12 all program CGPA results

Table 5a Descriptives
VAR00002

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|-------|-----|--------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| 1.00 | 182 | 3.1282 | .62108 | .04604 | 3.0373 | 3.2190 | .25 | 4.15 |
| 2.00 | 182 | 2.7912 | .80601 | .05975 | 2.6733 | 2.9091 | .25 | 4.15 |
| 3.00 | 173 | 2.5311 | .76662 | .05829 | 2.4161 | 2.6462 | .25 | 3.75 |
| 4.00 | 385 | 2.7824 | .56351 | .02872 | 2.7259 | 2.8389 | .25 | 4.15 |
| Total | 922 | 2.8052 | .69326 | .02283 | 2.7604 | 2.8501 | .25 | 4.15 |

Table 5b Test of Homogeneity of Variances
VAR00002

| | | | |
|------------------|-----|-----|------|
| Levene Statistic | df1 | df2 | Sig. |
| 12.319 | 3 | 918 | .000 |

Table 5c ANOVA
VAR00002

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|--------|------|
| Between Groups | 32.217 | 3 | 10.739 | 24.020 | .000 |
| Within Groups | 410.426 | 918 | .447 | | |
| Total | 442.643 | 921 | | | |

Table 5d Multiple Comparisons
VAR00002
Tukey HSD

| (I) VAR00001 | (J) VAR00001 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--------------|--------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1.00 | 2.00 | .33701* | .07009 | .000 | .1566 | .5174 |
| | 3.00 | .59706* | .07100 | .000 | .4143 | .7798 |
| | 4.00 | .34577* | .06015 | .000 | .1910 | .5006 |
| 2.00 | 1.00 | -.33701* | .07009 | .000 | -.5174 | -.1566 |
| | 3.00 | .26005* | .07100 | .002 | .0773 | .4428 |
| | 4.00 | .00877 | .06015 | .999 | -.1460 | .1636 |
| 3.00 | 1.00 | -.59706* | .07100 | .000 | -.7798 | -.4143 |
| | 2.00 | -.26005* | .07100 | .002 | -.4428 | -.0773 |
| | 4.00 | -.25129* | .06120 | .000 | -.4088 | -.0938 |
| 4.00 | 1.00 | -.34577* | .06015 | .000 | -.5006 | -.1910 |
| | 2.00 | -.00877 | .06015 | .999 | -.1636 | .1460 |
| | 3.00 | .25129* | .06120 | .000 | .0938 | .4088 |

*. The mean difference is significant at the 0.05 level.

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