

A Suggested Method to Measure Intended Learning Outcomes of Academic Programs

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Abstract—College of Computer Science and Software Engineering at University of Hail is encouraged to improve its program intended learning outcomes especially after applying for ABET accreditation in 2016. This paper will introduce a new, powerful tool that follows suggested measurement method to indirectly evaluate the efficiency of its three computing programs. The tool will be based on the student grades in all related courses which considered being the most valuable information source in any academic evaluation process. This research aims to update the student with his achieved and unachieved program ILOs to give him the opportunity to improve his skills before graduating. On the other hand, if the student has graduated, the results can be used to identify the weakness areas in the program and develop them.

Keywords—program ILOs; quality assurance; measurement tool; program accreditation; computing education

I. INTRODUCTION

Nowadays, Quality Assurance plays an important role in defining the best practices in a group of systems. According to Van Damme (2002), quality assurance in higher education over twenty years has not managed to reach an agreement on how principles of quality should be described. After 2002 and because of the growth of proficiency within higher education institutions, several quality notions are compound to meet the system requirements. New concepts of quality have been developed and adopted by a range of universities. However, those concepts should match the external evaluation agencies. In computing colleges, the Accreditation Board for Engineering and Technology (ABET) is the most recommended agency to evaluate the computing learning system (Koehn, 1997). One of the most important standards of ABET is student assessments where the student results are used to measure the course intended learning outcomes that should lead to measure the program intended learning outcomes. Recently, many research papers have been done to investigate what kinds of assessment tools can be adopted to evaluate an academic program. McCartney and Sanders (2003) conducted two surveys that questioned the nature of assessment tools used by computing programs in United States. The result of their

work highlighted the need of new approaches. In this paper, a new measurement tool will be introduced to calculate and analyze the intended learning outcomes of a computing program. Firstly, a background of fundamental information in quality assurance including course program accreditation and intended learning outcomes will be covered. Then, a discussion of current measurement methods and the proposed one will be raised. Next, the suggested assessment tool will be discovered. After that, potential future works will be explored. Finally, the paper will be concluded with a conclusion.

II. BACKGROUND

A) Quality Assurance

Quality Assurance is a dependable method founded to determine, analyze and reduce faults in program outcomes (Austin, Fleming, Thielsen, Leahy & Millington, 2009). Mainly, practices, not people, are the interests and the topics of the evaluation process (Blumenthal and Laffel, 1989). Quality term can be identified with different meanings such as excellence, zero errors, fitness of purpose, transformation, threshold and improvements or enhancements (Campbell and Rozsnyai, 2002). However, the continuous changing outline of higher education has been defined in wide-ranging quality terms. In addition, a various number of evaluation mechanisms have been established at national and international levels. Those mechanisms include specific subjective and objective explanations for qualifications. Among the large number of agencies, reference list of qualities has been described worldwide to avoid inconsistent of work between quality assurance companies. Currently, the National Commission for Academic Accreditation & Assessment (NCAAA) and ABET have been selected to evaluate the quality of education in College of Computer Science and Software Engineering at University of Hail to ensure continuous improvement in its computing programs. High standards and strategies framework has been set by NCAAA (AlSaeed and AlSafeh, 2014) and ABET.

B) Program Accreditation and Intended Learning Outcomes

In 1973, the first program evaluation process began to evaluate the quality of services offered to people with disabilities in United States (Rubin and Roessler, 2008). Few years ago, accreditation agencies have defined specific performance indicators with expectations to guide the program quality evaluation process. Several standards have been identified to meet those expectations. A mostly recent published result from a data analyzed by Travares and Amaral (2016) provides evidences that several academic programs in Portuguese have been eliminated because of the strong influence of program accreditation that identified their lack of academic quality. However, this impact increases the awareness of the quality assurance role in the academic process. As a result, accurate and reliable tools have been adopted by universities to measure how much their program meets the agency standards (Austin, Fleming, Thielsen, Leahy & Millington, 2009). Program Intended Learning Outcomes (ILOs) measurement has been the widely-used approach of program evaluation by observing its performance statistically (Robson and Shor, 2000). In NCAAA, ILOs are classified into five domains by the National Qualification Framework (NQF) as shown in figure 1. In addition, list of verbs has been provided in order to express the program or course ILOs such as design, define, judge and discuss.



Figure 1: National Qualification Framework Learning Domains

As indicated by Bergan (2007), Learning Outcomes (LOs) in academic programs state the "what a student can recognize, understand and execute. They focus on what the student has learnt during his study". Learning outcomes are not values that can be straightly noticed (Hager, 1994). According to Kuh, Pace & Vesper (1997), the student results might be the only powerful document that contains helpful data while measuring ILOs.

III. DISCUSSION

University of Hail and under the supervision of its Quality Assurance Deanship measures the course ILOs every semester from the course results. On the other hand, only internal and external qualification tests along with program evaluation surveys based on several feedbacks are annually conducted to assess the program ILOs. The procedures of calculating the program ILOs with valuable numbers gathered from the student grades in courses assessments have not been implemented or even declared. As a result, it is believed that there is no accurate answer in how much the program meets his ILOs and what kinds of skills its graduated students have gained. Clearly, a new measurement tool is strongly needed to improve the quality assessment methods currently used by University of Hail. A relevant discussion has been reported by Aamodt and Hovdhaugen (2008) and reveals that it is a challenge to focus on individual student's learning while measuring the program ILOs. The upcoming proposed tool faced that challenge in not only measuring the individual learning outcomes of the computing program students but also in calculating the learning of the graduated ones.

IV. THE SUGGESTED MEASUREMENT TOOL

There are no doubts that program ILOs can be measured easily and correctly from three valuable information sources.

- Student Grades analysis sheet: It is believed that student grades sheet is the most important document in the evaluation process. Because of this, a sheet can be generated and analyzed from all the original course grade sheets. This sheet will reflect the student statistical results in every assigned assessment through all courses taught in the program and motioned in its study plan. The percentages appear in table 1 are reporting how much the student gains in specific course ILOs. They are classified into two categories: achieved ILOs and unachieved ILOs. The percentage lower than 50 expresses the unachieved ILOs. Conversely, achieved ILOs are represented by percentages more than or equal to 50. To accurately retrieve the individual student grades, Banner system, the official platform of University of Hail, can be used.

Table 1: A sample of ICS353 Course Grades sheet. It shows that the computer science student with id 201356874 has achieved course ILO 2.3 and has not achieved course ILO 1.5 and course ILO 2.4.

ICS353 Course Grades			
CS Student ID	ILO 1.5	ILO 2.3	ILO 2.4
201356874	40%	70%	20%

- Program Matrix: Matrix where computer science program courses are mapped to their associated program ILOs. To create this table, two documents are needed, observed program ILOs and its related courses. However, and as shown in table 2, only the code of the course is mentioned. In this document, ILOs should be carefully written, approved and clearly describe what the student expected to learn through the program.

Table 2: A sample of Computer Science Program Matrix shows that ILO 2.5, Differentiate between different representation, techniques and models used to solve a problem, is related to ICS353 and ICS413, two courses taught in computer science program and mentioned in its study plan.

Computer Science Program Matrix					
#	Program ILOs/Courses	ICS102	ICS201	ICS353	ICS413
1.9	Recall the concepts of programming languages.	✓	✓		
2.5	Differentiate between different representation, techniques and models used to solve a problem			✓	✓

- Course Map: A matrix that maps the course ILOs to its program ILOs at the course level as shown in table 3. This detailed information is required by the analysis step.

Table 3: A sample of ICS353 Course Map shows that program ILO 2.5 is especially related to ICS353 Course ILO 1.5.

ICS353 Course Map					
Program ILOs/Courses ILOs	1.1	1.5	2.3	3.2	4.3
2.5		✓			

All the above three documents should be strongly connected to each other. Because of that, the program ILOs will be directly affected by the student marks. This approach can be implemented for each student of any program. Once the teacher enters the grades into the Banner system, the student can see his achieved and unachieved skills depending on the program ILOs. In addition, the highlighted weakness areas where the student gains lower grades than expected can be displayed on his personal Banner account. This will lead him to know in

which future courses he needs to improve. If the student has graduated from the college, his performance can be very useful in answering the main question in the program evaluation process, how much the program meets its major goals. Program ILOs, course ILOs, program map and student grades in each course must be entered and kept in a secure place such as the Banner system. The measurement tool output should be electronically calculated, analyzed and announced by the same system to avoid any case of data inconsistency. A general report can be produced to summarize the evaluation results. This report can be recursively connecting the main information sources discussed above. An example is shown below in figure 2 to describe the suggested method.

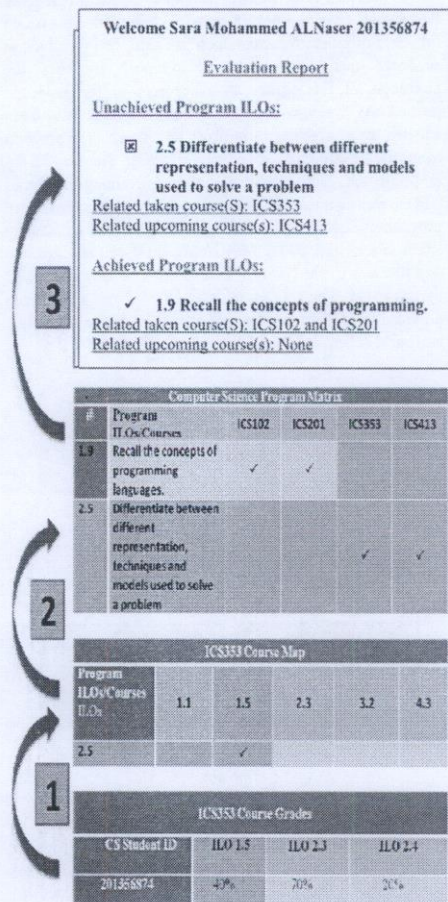


Figure 2: The suggested measurement method that evaluates the program ILOs through the student grades.

V. FUTURE WORK

The proposed tool can be simulated and analyzed with actual student results. A new research paper can be written in checking the accuracy of the method. A program level assessment gathers all the student reports can be established and tested.

VI. CONCLUSION

To sun up, University of Hail supports computer science and software engineering college to improve the quality of its academic learning system to meet the standards of national and international accreditation agencies. Unfortunately, and because of the ineffectiveness of the current measurement tools, the results of internal and external qualification tests given to the students last year indicates that there is a lack in achieving the program ILO. Student does not know his own unachieved program ILOs. If he got the ability to know after displaying his marks, he will get the chance to improve his skills in the future courses which will lead to improve the overall program ILOs. As a result, a suggested measurement tool has been proposed with effective design and implementation methods. This tool is based on the most realistic factor in the program evaluation process, the student grades. The tool should be implemented within a secure and confidential platform. Banner system functionalities can be expanded to measure the quality of computing education.

REFERENCES

- [1] Aamodt, O., & Hovshaugen, E. (2008). Assessing higher education learning outcomes as a result of institutional and individual characteristics NIFU STEP. Paper presented at the General Conference Outcomes of higher education: quality relevance and impact Paris, France: BMHE.
- [2] ALSaced, N, and ALSaleh, M. (2014). "Assessing Educational Reforms In Higher Education In The Kingdom Of Saudi Arabia- Challenges And Opportunities". Literary endeavour. Available at: <http://www.literaryendeavour.com> [Accessed: 14 January 2017].
- [3] Bergan, S. (2007) *Qualifications. Introduction to a concept*. Strasbourg: Council of Europe Publishing.
- [4] Campbell, C. and Rozsnyai C. (2002) *Quality Assurance and the Development of Course Programmes*, UNESCO CEPES, Papers on Higher Education
- [5] Kuh, G. D., Pace, C. R., & Vesper, N. (1997). The development of process indicators to estimate student gains associated with good practices in undergraduate education. *Research in Higher Education*, 38, 435-454.
- [6] Koehn, E. (1997). "Engineering Perceptions of ABET Accreditation Criteria," *Journal of Professional Issues in Engineering Education and Practice* 123(2), 66-70.
- [7] Laffel, G. Blumenthal, D. "The case for using industrial quality management science in health care organisation". *Journal of the American Medical Association*, 1989;262:2869-2873.
- [8] Leahy, M. J., Thielsen, V. T., Millington, M. J., Austin, B., & Fleming, A. (2009). "Quality assurance and program evaluation: Terms, models, and applications in rehabilitation administration". *Journal of Rehabilitation Administration*, 33(2), 69-82
- [9] McCartney, R. and Sanders, K. E. "Program Assessment Tools In Computer Science: A Report From The Trenches". In *SIGCSE '03: Proceedings of the 34th SIGCSE technical symposium on Computer science education*, pages 31-35, New York, NY, USA, 2003. ACM.
- [10] Robson, R. and Shor, M. (2000) A Student-Centered Feedback Control Model of the Educational Process. *Frontiers in Education Conference, 2000. FIE 2000. 30th Annual*, Volume: 2, Page(s): S1A/14-S1A/19 vol.2
- [11] Rubin, S.E., & Roessler, R.T. (2003). *Foundations of the vocational rehabilitation process* (6th ed.). Austin, TX: Pro-Ed.
- [12] Travares, O. and Amaral, A. (2016). "The Impact Of Programme Accreditation On Portuguese Higher Education Provision", Taylor & Francis Online, pp. 1-12. available at: www.tandfonline.com/doi/full/10.1080/0260293X.2016.1203860 [Accessed January 5, 2016].
- [13] Van Damme, D. (2002). "Trends and models in international quality assurance and accreditation in higher education in relation to trade in education services", paper presented at The OECD/US Forum on Trade in Educational Services, Washington, DC, May 23- 24. Available at: <http://www.oecd.org/education/skills-beyond-school/2088479.pdf> [Accessed January 5, 2016].