

Model-based Assessment of College Alumni Applied to Computer Engineering and Sciences*

A. M. ARTOLI and HASSAN MATHKOUR

College of computer and Information Sciences, King Saud University, P. O. Box 51178, Riyadh 11543, KSA.

E-mail: aartoli@ksu.edu.sa; binmathkour@yahoo.com

In the fields of computer engineering and computer science, it is crucial for academic institutions to update their curriculum and develop their environment in response to raised opinions of college stakeholders, mainly college alumni and employers. Program outcomes and alumni competence need be measured and analyzed periodically and their results must be conveyed to curriculum committees, administration, enrolled students and policy makers within the college and the institution. The main purpose of this work was to relate program outcomes with the college and university objectives, to measure the alumni satisfaction on the college programs, and to report the progress of alumni and stakeholder satisfaction in the College for Computer and Information Sciences. We report here the progress in quality and competency of the college alumni as compared to a previously conducted survey.

Keywords: Model-based assessment; computer engineering education; quality of computer engineering education

1. Introduction

Universities are multidisciplinary high education organizations established for three main goals: to produce high impact research, to graduate competent alumni and to participate in community services. University employee and stakeholders work hard to achieve these goals by means of implementing strategies and monitoring the institutional activities via measured performance indicators. Surveys are key tools that enable us to measure the degree of satisfaction from the opinions of stakeholders, alumni, administration, faculty and staff. Institutional entities routinely conduct these surveys, measure their performance indicators and report the results to relevant entities for taking actions targeting possible development.

Colleges are the academic and administrative divisions offering programs of similar characteristics within the university. It is the program outcomes which determine the success and reputation of the university. The most sensitive measure for program outcomes is the success of its alumni in their working life.

Alumni remain the main educational process outcomes in higher education institutions and the interaction of the college with its alumni is receiving increased global attention. We attribute this to three main factors: the world economic recession has made both colleges and stakeholders to be more concerned about the feasibility and future of college program outcomes. College input and opinion of funding institutions are directly affected by their impression on the competence and competitiveness and benefits of program outcomes. Second, most

academic institutions have ambitions toward better position in world university rankings, which requires continuous assessments of input, environment and outcomes and consequent re-engineering of college curricula, policy and all academic processes. Third, with local and global increased number of informatics harvest and increased demands for competency, university administration and stakeholder advisory boards mandate that colleges must distinguishably demonstrate the competitiveness and quality of their alumni. The program outcomes may be measured in terms of alumni job satisfaction, student gains and engagement in civic activities. There are three ways to estimate these by:

1. Measuring the alumni satisfaction via a conducted survey,
2. measuring a stakeholder opinion on the program outcomes, and
3. analyzing the progress in job hunting of the program alumni.

Due to its changing nature and its applied professional technology, alumni from the field of computer engineering and Science face increasing demands and challenges during their study and career periods. The large harvest and the vastly developing new technology put a burden on the academic institutions to make their alumni highly competitive and continuously demanded by the job market.

2. Related work

Competency models have received increased popularity with the development in the learning process

and its increased complexity in response to the complex nature and future sustainability of job market and stakeholder desires. Most engineering education institutions are involved in national and international accreditation processes which require periodical measurements for mean and variance of competency components [e.g. 1–5]. Numerous attempts to classify and build competency models are available in the literature [e.g. 6–8]. Nowadays, with the influence of globalization, a unified definition and means of measurement for competency in engineering education is essential. Generic models and approaches in this direction are scarce [e.g. 2, 8–10]. Therefore, a need for design and utilization of generic and adaptive competency models is witnessed. These models need to be built as linked lists of logically independent measurable or observable components and updated periodically according to stakeholder opinions and job requirements.

3. Model

We seek a technique for achieving alumni competency, commitment and lifelong learning abilities. The three features are defined as follows:

3.1 Competency

Competency is a set of related abilities, commitments, knowledge and skills gained for more effectiveness. We adopt the educational approach to define competency as “The development of skills, achievement of standards and award of credentials” [11].

Strategic areas of competency include competence in ICT. For the CCIS college, competence in computer science, information science, information technology, computer engineering and software engineering is the goal. Competence requirements for each of these disciplines are needed. These requirements are injected in the college program curricula and frequently assessed by the college internal quality management system (QMS) and reviewed by national (NCAAA) and international (ABET) accreditation boards. The matrix shown in Fig. 2 illustrates the competence processes running in King Saud University and CCIS to guarantee competitive competence of program outcomes. First the selection policy of King Saud University is based on a number of factors to select the best applying students. Selected students enter a preparatory year to gain “core competencies” such as communication skills, innovative thinking and team work. A college enrollment criterion is then applied to enroll the students in a discipline suitable to their capabilities. Program specific competencies are gained accumulatively during the study period. During the last year, just before graduation, stu-

dents gain heavy professional and cross-cultural skills from the provided vocational training opportunity in the job market. The college QMS system, surveys and accreditation processes assess, develop and review all these competence processes routinely (the last row in Fig. 2).

3.2 Commitment

Adopting the Allen and Meyer three dimensional model for organizational commitment [11] we define the institutional commitment in terms of affective, continuance and normative behaviors. The affective commitment in academic institutions could be measured by collecting feedbacks from faculty, staff, students and alumni on factors such as equity, participation and dependability. The student retention and termination of faculty and staff rates reflects the continuance behavior within the institution, which may be enforced by strengthening mutual benefits such as preparing students for the job market, continuous improvement of the learning and working environment and investigating termination cases. Normative commitment is about how morally faculty, staff and alumni are obliged to repay the institution. An indirect measure to this is to conduct surveys by means of organizational culture questionnaires (OCQs) on reasons for selecting the institution and the alumni-college relationship. Numerous factors have direct impacts on the level of institutional commitment. Of these, work environment, employment opportunity and positive relationships are the most important. The OCQs should involve dimensions measuring the goodness of these factors.

3.3 Lifelong learning

The European working definition for lifelong learning is based on learning activities undertaken to improve knowledge, skills and competence [10]. On the other hand, the Association of American Colleges and Universities define and measure lifelong learning skills in terms of rubrics defining curiosity, initiatives, independence, transfer and reflection [12], it is possible to determine the existence and effectiveness of lifelong learning abilities involved in a program content. Lifelong abilities must be injected during the college study period in terms of curriculum contents of informal learning patterns, seriously evaluated self-study sections; e-learning and massive open online courses. Case studies from real professional life are quite useful if effectively applied. Critical thinking and problem solving skills are also very effective tools for building lifelong learning abilities. It is however difficult to provide evidences that these lifelong abilities were useful to college alumni for sustaining the learning process

during their lifespan. Survey outcomes and rubrics measurements may provide such evidences.

4. Case study

In the Kingdom of Saudi Arabia, the annual ICT harvest is more than five thousand alumni in computer and information sciences [13]. Since its establishment, the college has graduated 44961 male and 2276 female alumni in computer engineering, software engineering, computer science, information science and information technology [14]. All these programs are accredited by the Accreditation Board for Engineering and Technology (ABET) and are engaged in a national accreditation program (National Commission for Academic Accreditation & Assessment) both demanding specific performance indicators on the quality, environment and suitability of alumni to current job demands.

The college has a growing database on the status of its alumni and conducts annual surveys to tracks on college input, undergraduate-students, fresh, two-years and four years old alumni periodically. Another survey is conducted on sample employers in search for advices towards developing new curricula or re-engineering existing curricula to meet the stakeholder’s demands.

Achieving distinction in information technology and telecommunication is one of the main excellence goals in objective 1 of the KSU-2030 strategic plan (good everywhere; great in focus areas). In addition, the fourth goal targets strengthening

competence of the university alumni. Based on this the college of computer and information sciences (CCIS) is committed to an action plan with the following objectives:

1. Sustain excellence in learning experience.
2. Ensure creative and innovative research.
3. Strengthen graduates’ competitiveness.
4. Bolster faculty and staff performance.
5. Support continuous improvement through national and international partnerships.
6. Expand the college impact on local society.

Of these, the third objective requires that alumni and their employers should be satisfied on their performance and work experience after their graduation. This mandates a life-long relation between colleges and their alumni. The CCIS college at King Saud University has established an alumni unit to keep tracking its alumni and conduct frequent surveys to measure their satisfaction, to report their comments and suggestions to suitable entities within the college and to monitor the progress of competence and enhancements in the working environment.

The CCIS college runs five programs in computer science discipline for one main objective: to produce alumni with

1. Competency in various computing disciplines.
2. High commitment to ethics, values and devotion.
3. Life-long learning abilities.



Fig. 1. King Saud university conceptual model for guaranteeing program outcomes.

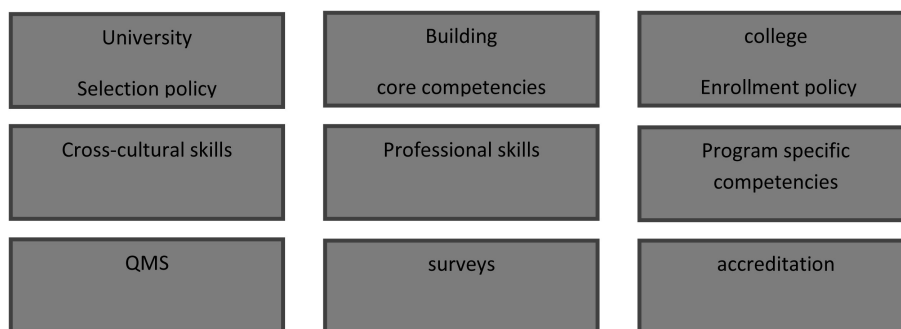


Fig. 2. CCIS competency matrix.

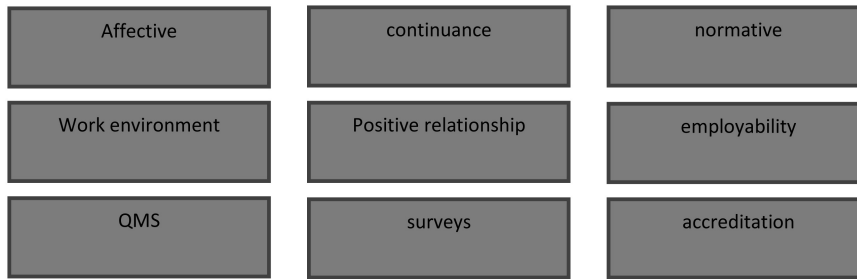


Fig. 3. CCIS commitment matrix.

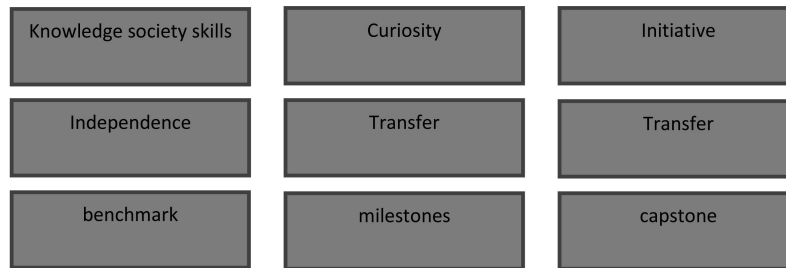


Fig. 4. CCIS lifelong learning abilities matrix.

The mapping of university-college-program objectives is illustrated in Fig. 1. From this figure, we realize that alumni are the only measure of how good the programs are and to what extent they achieve their objectives. Based on this, we will focus on the college alumni as the main factor that has direct impact on the college objectives.

5. Observations

King Saud University (KSU) is actively engaged in implementing a strategic plan targeting excellence and leadership by 2030. The strategy action plan demands that all college programs must be accredited from an international accreditation board such as ABET, and program outcomes must be identified, monitored and should prove enhancing every year.

Consequently, teaching, research and administrative environments are adapted for meeting these demands. The university annually conducts a survey wave asking the opinions of its alumni, stakeholders, faculty and staff on different issues related to certain performance indicators linked to the goals of the university in the strategic plan. Colleges do also have strategic goals and programs have ambitious objectives, mostly fall in enhancing the teaching environment as a requirement for graduating competent alumni, engagement in high quality research as the key element in having better ranking, and contributing to the community by means of research and education.

Here we will focus only on the survey conducted on alumni and employers on the CCIS-KSU college

and discuss the impact of its findings on the development in the program objectives, college goals and university strategic plan. The survey was conducted during the year 2012.

This work reports result of the surveys conducted on 300 alumni and 50 employers during the year 2012 as part of an annual university-scale survey. The paper will first hypothesize the survey, then explain the sample size and methodology and present the findings of alumni and employers survey. A discussion is given in the end.

The main objective of conducting such surveys is to monitor the development in stakeholder satisfaction in response to involved activities at the teaching and infrastructure levels. A conceptual model is thereafter built based on the college and university strategic plans in addition to the impact of national (NCAAA) and international (ABET) accreditation on the quality of college outcomes.

5.1 Sample

Based on data provided from the alumni unit for the college of computer and information sciences (CCIS) at King Saud University (KSU) we have gathered information about male college alumni who graduated during the last 7 years. The available database contains more than six thousand alumni since the college was established in 1987. Of these, we have selected alumni of accessible contact numbers, email addresses and/or work or home address. We first have selected a subsample of 300 alumni. The selected group ages range between 22–32 years old. We note that this survey was part of a comprehensive survey at the university level on alumni, faculty,

environment, research and stakeholders annually required for accreditation and strategic planning mandates. The survey took place within the City Region (100Km × 100 Km) and the data was collected and analyzed in the CCIS alumni unit during the last academic year (2012–2013) within 40 days. We assumed that the subsample covered in this survey represents adequately the larger sample of college male alumni during the last 10 years. Female alumni in King Saud University have their own working, research, teaching and stakeholder conditions, as they were separately educated and are working in different conditions, though they are tightly linked.

5.2 Methodology

5.2.1 Alumni survey

The alumni unit in CCIS has conducted a survey as part of the annual university survey wave targeting assessment of the educational process as a whole. The survey consists of 50 questions categorized in 5 dimensions and five degrees of freedom. In the beginning, we have asked 10 pilot alumni to give their opinion. Then we have modified the questionnaire accordingly. We have then delivered 300 surveys to the sample under study mainly in person or by email. The alumni survey is 5-fold:

1. General information
2. program content,
3. quality of teaching, and
4. infrastructure and
5. overall assessment

and five degrees of freedom (Totally agree, agree, somehow agree, disagree and totally disagree).

The first dimension aims at gathering general information on alumni, such as the program they were studying, graduation year and the period between their graduation and their first job (job hunting period). The second dimension surveys opinions on the quality of the program contents and its relevance to the required work skills. Students were asked whether the program has developed their critical thinking and problem solving skills, whether the program has helped them in developing their effective communication skills, knowledge and professional skills, research skills, decision making abilities, technical skills and whether or not they have received adequate academic supervision during their study. The third dimension is concerned with the alumni opinion on the quality of teaching and training alumni have received during their study period. Alumni opinion on the quality of teaching was measured in terms of analyzing their responses to 13 questions, including to what extent faculty have:

- Provided suitable tutorship and academic guidance.
- Demonstrated enthusiasm and interest to what they were teaching.
- Showing interest in enhancement of student achievement.
- Used effectively current and various teaching methods, instructional technology and assessment techniques.
- Discussed student performance with the students and provide suitable advice toward enhancing their performance.
- Encouraged scientific discussion and critical thinking among the students.
- Encouraged effective and cooperative teaching.
- Provided feedbacks on the student performance to stakeholders.

The fourth category evaluates the institutional environment during the study period such as the availability of equipment and preparedness of the laboratories, lecture rooms, learning management system, quality of technical support they were receiving, updated computer environment, services and outdoors facilities. Opinions on the adequacy of institution environment to people with special needs are also collected.

The survey ends with a section asking the alumni to provide general remarks, opinions and suggestions for the development of the educational processes in the college. An overall assessment for the quality of the program, satisfaction on the alumni life during their study period, quality of academic tutorship and faculty performance are asked. Alumni were asked in the end two main questions:

1. Whether or not they are proud of their institution and if they would reapply to the institution if given a second chance.
2. Whether or not they recommend to their colleague to enroll in the program they have studied.

5.3 Findings

Table 1 shows the number of questions categorized for each dimension and averages of missed responses. This table indicates that mostly all alumni were enthusiastic in giving their opinion

Table 1. Overall responses to survey questions

Dimension	Number of questions	Responders	Average missed responses
General information	9	73	2
Program contents	14	73	0
Quality of teaching	13	73	0
Environment	14	73	0
Overall assessment	9	73	0

Table 2. Percentage response levels to the program contents survey

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Totally agree (very satisfied)	14	14	14	17	8	19	11	10	15	10	14	13	8	10
Somewhat agree	65	50	47	42	31	35	32	22	38	25	33	22	40	24
Neither agree or disagree	15	24	26	26	44	31	32	29	28	36	33	42	28	35
Somewhat disagree	6	11	11	11	13	15	21	25	14	18	19	17	17	19
Totally disagree (very unsatisfied)	–	–	1	0	4	0	3	8	3	7	0	6	6	11
No answer	0	0	0	1	0	0	1	0	0	0	0	0	1	0
Not applicable	0	1	1	3	0	0	0	6	2	4	1	0	0	1

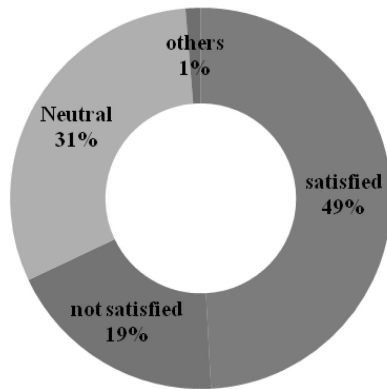


Fig. 5. Average percent alumni satisfaction on program contents.

about all dimensions. This is a direct impact on the applied college engagement policy with its alumni. In Table 2 we show the percentage response categorized in terms of levels of response to each question for this level. This table is summarized into three main categories: agree, not agree and neutral, as shown in Fig. 5.

5.3.1 Program contents

In CCIS, there are curriculum committees which get feedbacks from student and faculty surveys and further investigate suggestions and ways of enhancing the teaching and learning process throughout the year. These committees recommend amendments, elimination and upgrade of course contents and submit the suggestions to the department councils for approval. In the last two years, a number of major course contents were updated in response to the recommendation raised from these surveys, averaging to three per program.

Approximately, half of the alumni are satisfied with the programs they were studying, as presented in Fig. 5 and detailed in Table 2. However, more than 30% were neutral in their opinion, which is in general not expected, and requires more investigation. 20% of the alumni are not satisfied with the program content. The college is taking this as a serious issue. An ambitious project toward enhancing the capability and preparedness of alumni has been proposed and funded.

5.3.2 Quality of teaching

The collective alumni opinion on the style and quality of teaching is summarized in Table 3 while Table 4 and Fig. 6 shows the average trend of responses to this level. From the table, we realize that the students are in general satisfied on the quality of teaching they were receiving. Nearly half of the surveyed alumni (45%) have responded with total or partial satisfaction on the teaching process. It is to be noted that the performance of teaching has a long lasting impression on the students as they remember the good teaching approaches, good teachers and teachers of subjects on which they had good or excellent grades. This has negative impact on the reliability of the survey results as subjects known to be not easy to teach, difficult to excel in or non-core basic courses such as physics or mathematics will receive worst opinions. The college is working hard to enhance the teaching methodology and upgrade its faculty with suitable training.

One fifth of the surveyed alumni responded negatively to the quality of teaching. The above discussion on the grading and difficulty in learning core computer science courses may justify this finding.

Table 3. Percentage response levels to the quality of teaching from alumni survey

	1	2	3	4	5	6	7	8	9	10	11	12	13
Totally agree (very satisfied)	10	6	4	11	8	13	13		10	11	7	10	10
Somewhat agree	43	44	36	26	32	36	31	26	24	38	33	32	36
Neither agree or disagree	28	33	40	40	38	36	32	35	44	33	33	36	33
Somewhat disagree	14	13	14	18	18	11	18	15	15	13	19	17	17
Totally disagree (very unsatisfied)	4	3	4	11	11	3	4	6	1	3	1	4	3
No answer	1	1	1	1	1	1	1	1	1	1	1	1	1
Not applicable	0	0	0	1	1	0	1	0	0	1	1	0	0

Table 4. Satisfiability on the quality of teaching from alumni survey

	1	2	3	4	5	6	7	8	9	10	11	12	13
Satisfied	53	50	40	37	40	49	44	39	34	49	40	42	46
Not satisfied	18	16	18	29	29	14	22	21	16	16	20	21	20
neutral	28	33	40	40	38	36	32	35	44	33	33	36	33

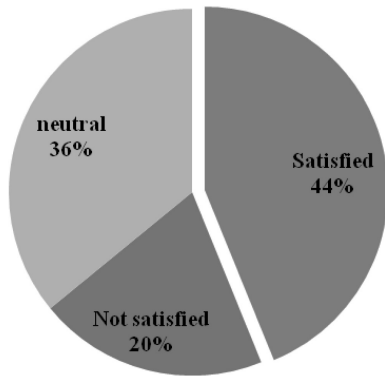


Fig. 6. Averaged opinion on the teaching quality—Alumni Survey.

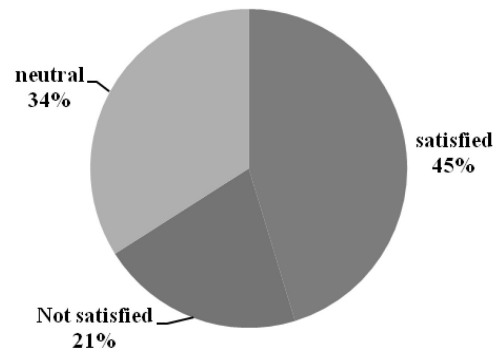


Fig. 7. Alumni Satisfiability on the teaching environment.

Again the neutrality problem is witnessed here, with 36% being neutral about the quality of teaching. A possible solution to this is to minimize the degrees of freedom by one by eliminating the “neither agree or disagree” option.

5.3.3 Environment

As listed in Table 5, and summarized in Table 6, nearly half of the surveyed alumni (45%) gave positive opinions on questions related to the teaching environment in the CCIS college. One fifth of them responded negatively and again more than one third of them were neutral. Though the college is highly equipped with internet connected e-podiums in all its lecture rooms, and though the main facilities are available in the campus, it seems that the students are seeking other means of having the college as more comfortable and enjoyable.

5.3.4 Overall satisfiability

Responses to the overall satisfiability questionnaire are depicted in Fig. 8 from which we realize that the overall evaluation for the college educational process is acceptable. However, according to the alumni opinion the college needed to enhance its working and teaching environments, especially the laboratories and the library. Only program quality has received high score. The other dimensions all required extensive effort to upraise. However, since the sample alumni have graduated (by 2008), many changes have been made, including moving to a newly established campus, involvement in international accreditation and execution of the university and college strategic plans. The main impact of the survey is the opinion on the program contents and the quality of teaching. An independent survey on fresh alumni revealed increased satisfiability on the environment (data not shown).

Table 5. Percentage alumni satisfaction on the college environment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Totally agree (very satisfied)	4	10	11	13	7	11	15	19	25	7	17	14	11	14
Somewhat agree	25	26	38	33	42	26	32	33	36	33	24	25	26	25
Neither agree or disagree	44	49	38	29	26	31	32	21	22	32	28	40	29	31
Somewhat disagree	11	7	10	14	17	24	15	18	13	13	24	8	13	13
Totally disagree (very unsatisfied)	10	3	4	7	3	3	4	6	1	8	4	8	10	4
No answer	1	3	3	1	3	1	1	1	3	3	1	1	1	3
Not applicable	4	0	0	3	3	4	0	1	0	4	3	3	10	11

Table 6. Alumni satisfiability on the college environment

Question #	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Satisfied	29	36	49	46	49	37	47	52	61	40	41	39	37	39
Not satisfied	21	13	11	21	20	27	19	24	14	21	28	16	23	17
Neutral	44	49	38	29	26	31	32	21	22	32	28	40	29	31

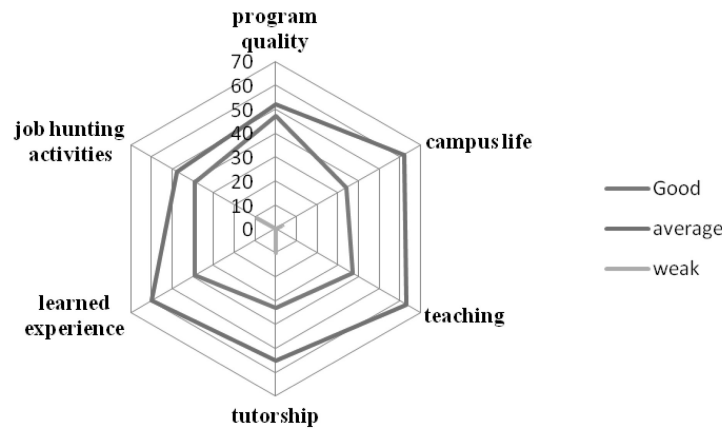


Fig. 8. Alumni Overall satisfiability. Good (blue), average (red) and weak (green) satisfaction levels on program quality, job hunting, learned experience, tutorship, teaching and campus life.

Table 7. Alumni commitment and pride responses

Category	Yes	No	No answer
Re-apply	44	53	3
Recommend enrollment	72	25	1

Table 8. Survey results for two consecutive overall alumni opinions

Opinion	2011–2012	2012–2013
Satisfied	27	46
Not satisfied	44	20
Neutral	29	34

An imbalance between the in-campus parameters (campus life, teaching, program quality and tutorship) and the after graduation college performance (job hunting and learned experience) is clear from Fig. 8. Teaching has gained the best opinion while job hunting activities received the least. In general, since the radar figure shows concavity on all dimensions, the overall college performance has received acceptable satisfaction.

5.3.5 *Pride and commitment*

Alumni pride was measured from two main questions:

- Whether or not they are proud of their institution and if they would reapply to the institution if given a second chance.
- Whether or not they recommend to their colleague to enroll in the program they have studied.

Responses are tabulated in Table 7. From the table, we realize that the college alumni do feel proud about their college from a point of view related to advising others to enroll in the college programs. However, they do not prefer to re-apply to the college if given a second chance. Perhaps the answers are not congruent due to the fact that the survey alumni were selected from technical and professional environments rather than academic or research oriented environments.

5.4 *Comparison with the previous survey*

The previous survey conducted last year (see Table 8 and Fig. 9) has measures 27%, 44% and 29% for

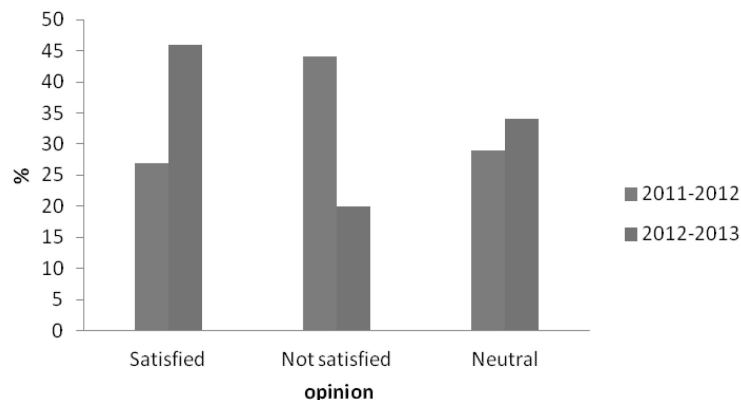


Fig. 9. Current (2012–2013) and previous (2011–2012) average alumni satisfiability on the college educational process

satisfaction, dissatisfaction and neutral opinions, respectively. The table and the figure compare average percentage opinions from the two surveys.

6. Discussion

A conceptual model for achieving program outcomes in the College of Computer and Information Sciences, King Saud University was outlined, focusing on alumni requirements and performance measurement. College input was also assessed by conducting surveys and analyzing data such as retention rate, excelling and asking freshmen students and their parents about their expectancies when they are graduating. Parents are also asked if and why they are supporting their son/daughter choice to be enrolled as a college student. Based on alumni data and their job satisfaction recruitability and willingness to continue in the field, curriculum committees are supposed to make use of these surveys to modify and update program curricula. Reforming the curricula in response requires designing of an action plan that complies with the institution and country strategies. It is also important to measure the level of alumni engagement in community service (paid or unpaid), how do they participate and contribute to community ambition, success stories in leadership and innovation are also documented and reflected to the advisory board.

The authors believe that it is hard to make an impact with alumni surveys unless the survey results are discussed extensively during departmental, college, administration and advisory board meetings. It is the decisions made by these committees, which really make an impact on the institution future. However, it was noticed that in CCIS-KSU, it needs more effort and time to realize and taste the fruit of conducting such surveys if relevant decisions are made based on rigorous analysis.

The current survey has witnessed considerable improvement in reference to alumni opinion. This is attributed to additional effort spent in the survey design and to major actions taken in the college, of which are the establishment of an alumni unit, enhancements made in the teaching environment and the accreditation of the programs by international boards.

7. Conclusion

Alumni are the major outcome of the educational process. We have introduced a model for assessing, monitoring and developing alumni skills to meet the changing demands of the job market in computer engineering and science disciplines. The model considers ways to evaluate alumni competency, their commitment towards the field and the community

and assess their lifelong abilities. The model may be used to manage the educational processes involved and have been applied on a sample of computer engineering and science students in King Saud University to evaluate program contents, quality of teaching and educational environment. The overall satisfiability of stakeholders have been surveyed and analyzed and used in developing and enhancing alumni competencies and strengthening their competitiveness within the study plan. The integration of university, college and program objectives into a unified framework is a complex process which requires simulation for the educational processes before imposing new policies to the running educational processes. Real time performance measurement of competency components is a complex operation which needs to be conducted on each individual alumni for each desired job. This remains a trend for both academic institutions and human resources managements. This would be related to individual variance in competency related to complexity indicators a utilized or created model shall be able to capture. These issues will be a subject of future work.

Acknowledgements—This work was supported by the Research Center of College of Computer and Information Sciences, King Saud University. The authors are grateful for this support.

References

1. J. S. Shippmann, R. A. Ash, M. A. Battista, L. Carr, L. D. Eyde, B. Hesketh, J. Kehoe, K. Pearlman, E. P. Prien and J. I. Sanchez, The Practice of Competency Modelling, *Personnel Psychology*, **53**, 2000, pp. 703–740.
2. R. Klendauer, M. Berkovich, R. Gelvin, J. M. Leimeister and H. Krcmar, Towards a competency model for requirements analysts information, *Systems Journal*, **22**(12), 2012, pp. 475–503.
3. H. Passow. Which ABET Competencies Do Engineering Graduates Find Most Important in their Work? *Journal of Engineering Education*, **101**(1), 2012, pp. 95–118.
4. J. W. Prados, G. D. Peterson and L. R. Lattuca, Quality assurance of engineering education through accreditation: The impact of Engineering Criteria 2000 and its global influence, *Journal of Engineering Education*, **94**(1), 2005, pp. 165–184.
5. L. Woollacott, Taxonomies of engineering competencies and quality assurance in engineering education. In A. S. Patil and P. J. Gray (Eds.), *Engineering education quality assurance: A global perspective*, pp. 257–295. London, UK: Springer, 2009.
6. P. S. Pottinger and J. E. Goldsmith, *New directions for experiential learning: Defining and measuring competence*. San Francisco, CA: Jossey-Bass, 1979.
7. H. K. Ro, D. Merson, L. R. Lattuca and P. T. Terenzini, Validity of the Contextual Competence Scale for Engineering Students, *Journal of Engineering Education*, **104**, 2015, pp. 35–54. doi: 10.1002/jee.20062
8. J. S. Shippman, R. A. Ash, L. Carr, B. Hesketh, K. Pearlman, M. Battista, L. D. Eyde, J. Kehoe, E. P. Prien and J. I. Sanchez, The practice of competency modeling, *Personnel Psychology*, **53**, 2000, pp. 703–740.
9. J. Lucena, G. Downey, B. Jesiek and S. Elber, Competencies Beyond Countries: The Re-Organization of Engineering Education in the United States, Europe, and Latin America,

- Journal of Engineering Education*, **97**, 2008, pp. 433–447. doi: 10.1002/j.2168-9830.2008.tb00991.
10. European Union, European Reference Framework. “Key competencies for lifelong learning” *Official Journal of the European Union*, 30 December 2006/L394.
 11. N. J. Allen and J. P. Meyer, Affective, Continuance, and Normative Commitment to the Organization: An Examination of Construct Validity, *Journal of Vocational Behavior*, **49**(3), 1996, pp. 252–276.
 12. Association of American Colleges and Alumni, <http://www.aacu.org/value/rubrics>, Accessed 10 November 2013.
 13. Saudi Ministry of Higher Education- Higher Education Statistics Center, <http://www.mohe.gov.sa>. Accessed 10 November 2013.
 14. College of Computer and Information Sciences. Archive of the Student Affairs Unit. Accessed 10 November 2013.

Abdel Monim Artoli is a professor in the Computer Science Department, College of Computer and Information Sciences since 2011. He is the head of the college alumni unit and a strategic planning consultant. Artoli has obtained his Ph.D. from University of Amsterdam in 2003 in computational biomechanics. His research interest includes high performance computing, optimization, biomechanics and modeling of complex systems.

Hassan I. Mathkour is a professor in the Computer Science Department and dean of the College of Computer and Information Sciences. He obtained his Ph.D. in computer Science from the University of Iowa. His research interest includes bioinformatics, expert systems, intelligent systems and quality in higher education.