University of Puerto Rico at Bayamón

2013-2016 Cycle

Continuous Improvement Report
Information Systems

This report provides the analysis of the achievement of the Student Outcomes for the Information Systems emphasis area of the Computer Science Department

Introduction

This document presents the assessment of the Student Outcomes (SO) of the Information Systems emphasis area (program) of the Department of the Computer Science for the University of Puerto Rico at Bayamón for the cycle 2013-2016. Analysis of the SOs is performed using two main tools: post-test and the graduate (exit) questionnaire. If there is a discrepancy between these tools data obtained from the courses is analyze for triangulation.

Remark on the Post-Test Results

Most of the data to evaluate the outcomes are made through Performance Indicators (PI). At least two questions are drafted in the post-test to measure most PIs. This is evident after the post-test revision of 2015. However, some of the data used for our analysis have included results prior to this revision. We harmonized results from the previous post-test and the revised them in order to prepare this report.

Information Systems Program - Student Outcomes Data Analysis

This section presents the analysis of the Student Outcomes for the Information Systems emphasis area (program) at the University of Puerto at Bayamón. Each outcome was further divided into performance indicators and was analyzed using at least two instruments: one direct measurement and one indirect measurement. The main direct measurement for most of the outcomes was the post-test given to all students enrolled in our Capstone course (SICI 4038). The other outcomes were assessed using data obtained from the courses either by rubrics or analyzing the coursework. The main indirect measure is a survey administered to the students in our Capstone course named the Graduate Questionnaire. Whenever a discrepancy is found, relevant materials from the courses are analyzed.

As in previous cycles we used the results from the post-test questions for further analysis. The analysis assumed the following scale:

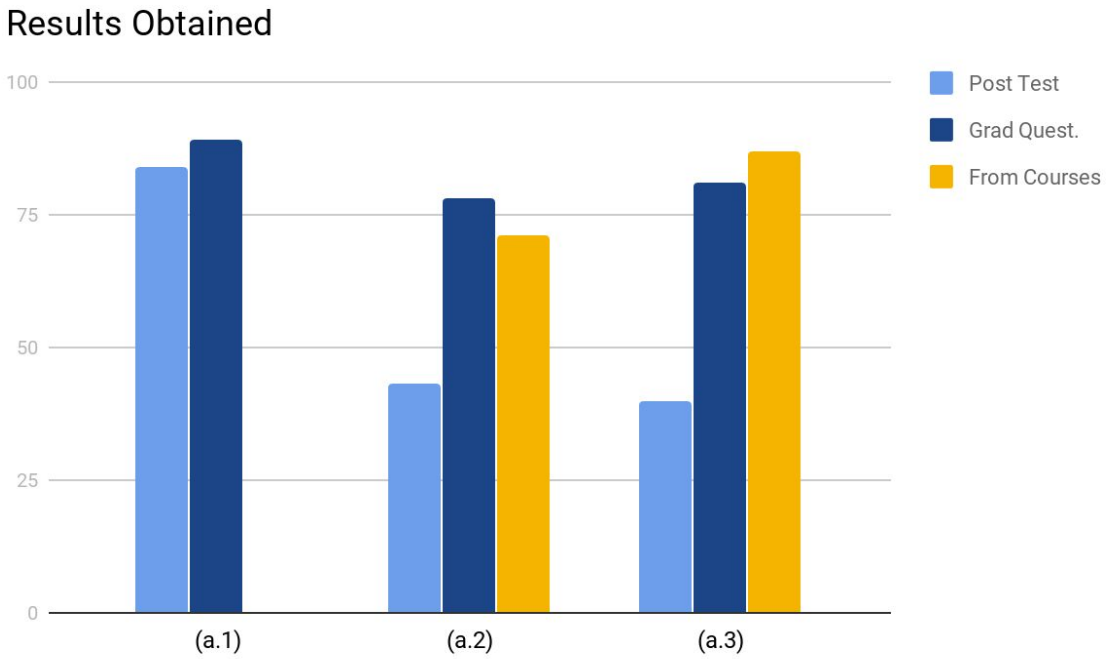
- Satisfactory – the question was correctly answered by at least 75% of the students.
- Developing – the question was correctly answered by at least 50% of the students but less that 75%.
- Unsatisfactory – the question was correctly answered by less than 50% of the students.

For the student survey, the analysis assumed the following scale:

- Satisfactory – the indicator was graded as A or B by the student.
- Developing – the indicator was graded as C by the student.
- Unsatisfactory – the indicator was graded as D or F by the student.

Student Outcomes Analysis

Outcome a: An ability to apply knowledge of computing and mathematics appropriate to the discipline



This outcome is measured by three main performance indicator.

(a.1) Select the appropriate algorithm for an specific situation
On average 84% of our student answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of B in average 89%. Therefore the AAC concluded that the achievement level for this PI was met.

(a.2) Analyze the asymptotic running time of algorithms using big-O notation
On average 43% of our student answered the questions related to this PI correctly. We considered this results to be very low. However, all the students that completed the graduate questionnaire gave this indicator a grade of 78% (high C). We analyze data obtained from Quiz #2 of the SICI 4036-Data Structures. These were the first 5 questions of section 1. After grading only this part for 18 quizzes we obtained a median of 71%. Therefore, we concluded that the achievement level for this PI is developing.

(a.3) Apply mathematical concepts in the solution of a given problem

On average 40% of our student answered the questions related to this PI correctly. However, all the students that completed the graduate questionnaire gave this indicator a grade of 81%. Therefore, we choose to analyze data obtained from the course COTI 4150 Information Systems Programming. After speaking with faculty we decided to analyze questions II.1 and II.2 of Quiz 3. An average of 87% was obtained from question II.1 and 75% for question II.2. Consequently, we concluded that the achievement level for this PI was met.

Previous Cycle Comparison

Comparing last assessment cycle with this one we can see that for PI (a.1) there has been a 9% increase on the grades obtained from the post-test. Also the students gave this indicator a strong satisfactory grade on the questionnaire. On average 43% of the students answered the questions correctly for performance indicator (a.2). This grade is lower than previous assessment-cycle. However, after analyzing the results from the courses there was an improvement of 23% in this performance indicator.

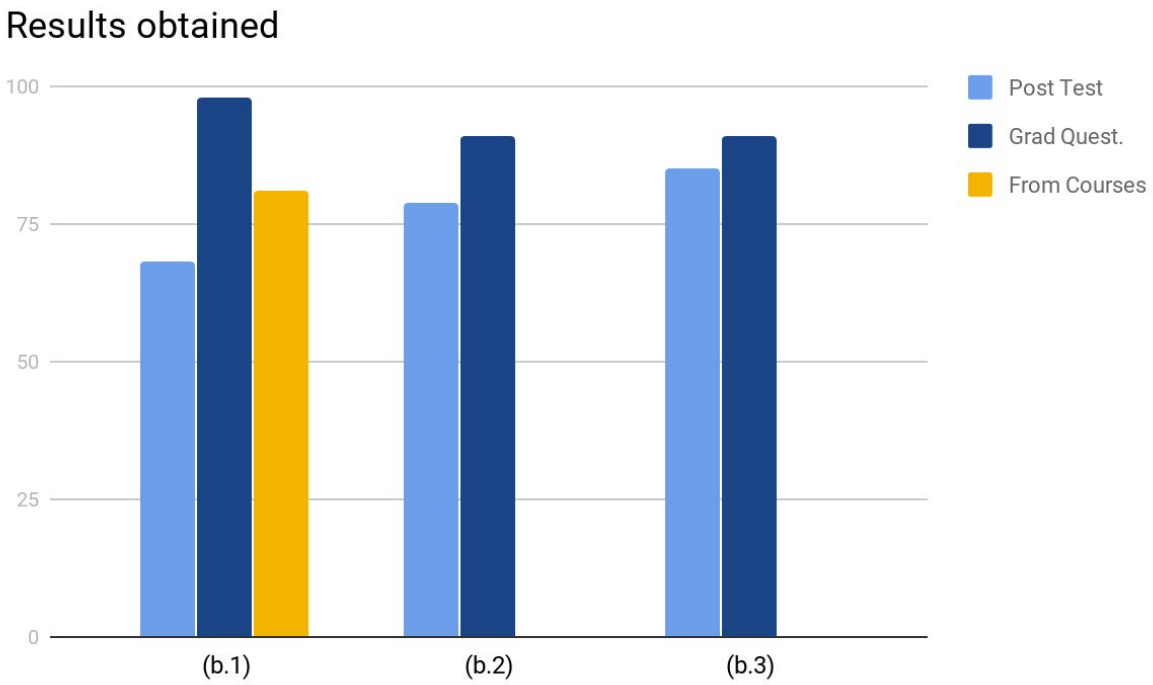
Comparing last assessment cycle with this one we can see that for PI (a.3) there has been a decrease of 10% on the results obtained from the post-test in this cycle. However, students show more confident on this PI when answering the graduate questionnaire (81%).

Conclusions and Recommendations

The AAC concluded that this outcome is partially met. The committee recommends:

- Reflection: Are the questions/problems in the post-test appropriate to Information Systems emphasis area? We are giving the same type of questions for the IS and CS programs. A question that we must made to ourselves is: Do students belonging to the IS program need to answer these questions? These are open questions we must address in the next post-test revision. Also, the type of mathematical concepts applied in course COTI 4150 are high school or freshmen level, for PI (a.3) (i.e. calculating GPA) and we used those questions to make our analysis.
- Recommendation: Since IS students are not required to take COTI 4255 Analysis of Algorithms questions in the post-test should be different than those questions asked to the CS students. Also, the AAC needs to identify if the topics entailing this PI need further reinforcement.

Outcome b: An ability to analyze a problem, identify and define the computing requirements appropriate to its solution.



This outcome is measured by thee performance indicators. This PIs are the following:

(b.1) Analyze a problem

Only 68% of the student answered this question correctly. However, they show confidence in this PI on the graduate questionnaire since they graded themselves with 98%. The AAC decided to analyze data obtained from the course SICI 3015 Analysis and Design. In most of the practical exams given by the professor the students have to read a problem, analyze it and design a solution for the problem. We have decided to analyze the grade for the partial exam #2. The mean grade obtained in this exam was 81%. Therefore, the AAC concluded that the achievement level of this PI was met.

(b.2) Identify and define the computational requirements needed in a real situation
On the post-test 79% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 91%). Therefore, the AAC concluded that the achievement level of this PI was met.

(b.3) Choose the appropriate software and/on hardware tools to meet the desired goals

On the post-test 85% of the students answered the questions related to this PI correctly. Also, all the students that completed the graduate questionnaire gave this indicator a grade of A (as in previous PI an average of 91%). Therefore, the AAC concluded that the achievement level of this PI was met.

Previous Cycle Comparison

Last time the AAC recommended to *build some assessment tools to effectively measure* the indicator. The problem was that last time we couldn't find a suitable place for measuring this outcome. This time we choose SICI 3015 SICI Analysis and Design as the suitable place for measuring the PIs.

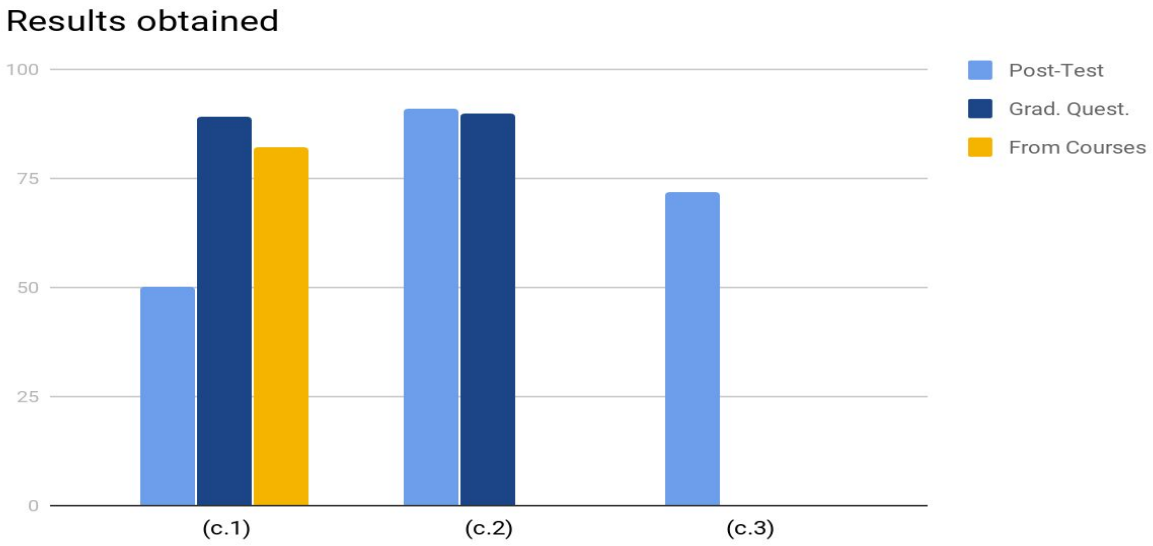
Comparing last assessment cycle with this one we can see that for PI (b.1) there has been a decrease on the grade obtain on the post-test. However, there was a slight increase of 2% for PI (b.2) and a 25% increase for PI (b.3) on the post-test. We didn't need to analyze grades obtained from the courses last time.

Conclusions and Recommendations

After analyzing each performance indicator for outcome b we can conclude that the outcome was met.

- Reflection: the mean grade of PI (b.1) was 68% in the post-test. It is drafting of the question the problem for PI (b.1)? Is the question is appropriate to IS? Students in CS were border line in this performance indicator with a mean grade of 74%. The AAC recommend to review the questions of the post-test for this PI.

Outcome c: An ability to design, implement, and evaluate a computer-based system, process, component or program to meet desired needs.



This outcome is measured by thee performance indicators. This PIs are the following:

(c.1) Design solutions using pseudo code, diagrams or natural languages.

On the post-test just 50% of the students answered the questions related to this PI correctly. This is unsatisfactory and alarming for the AAC. However, all the students that completed the graduate questionnaire gave this indicator a grade of B (an average of 89%). Since there is an abysmal discrepancy the committee decided to examine the coursework. The AAC decided to analyze data obtained from the course SICI 3015 Analysis and Design. In this course, students have to develop diagrams as the Entity Relationship Diagram (ERD), use case, activity and state machine diagrams. The committee decided to analyze the grade from the final exam. The mean grade obtained in this exam was 82%. Therefore, the AAC concluded that the achievement level of this PI it is classified as developing.

(c.2) Implement an algorithm using the appropriate programming language

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 91%). After looking at some of the SICI 4038 (Capstone Course) projects we can conclude that students are able to implement a system in almost any language. We have seen many projects in Microsoft and Non Microsoft environment, for example, Android and Web based. This have been

evident to us when looking to the posters presented by the students in the capstone course. Therefore, the committee declared that this PI was met.

(c.3) Perform both unit and system testing

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 72%). All students that take course SICI 4036 Data Structures are using JUnit to test their programs. We now that just lately we have added this to the courses. Some students indicated on the graduate questionnaire that they don't have knowledge about this and this is true. However, many students performed unit and system testing when building programs of varying complexity but couldn't identify the test they were performing as a unit or system testing. They just only know they test the program by "including and testing" each method/procedure or function they were added to the system. Therefore, the AAC classify this PI as developing.

Previous Cycle Comparison

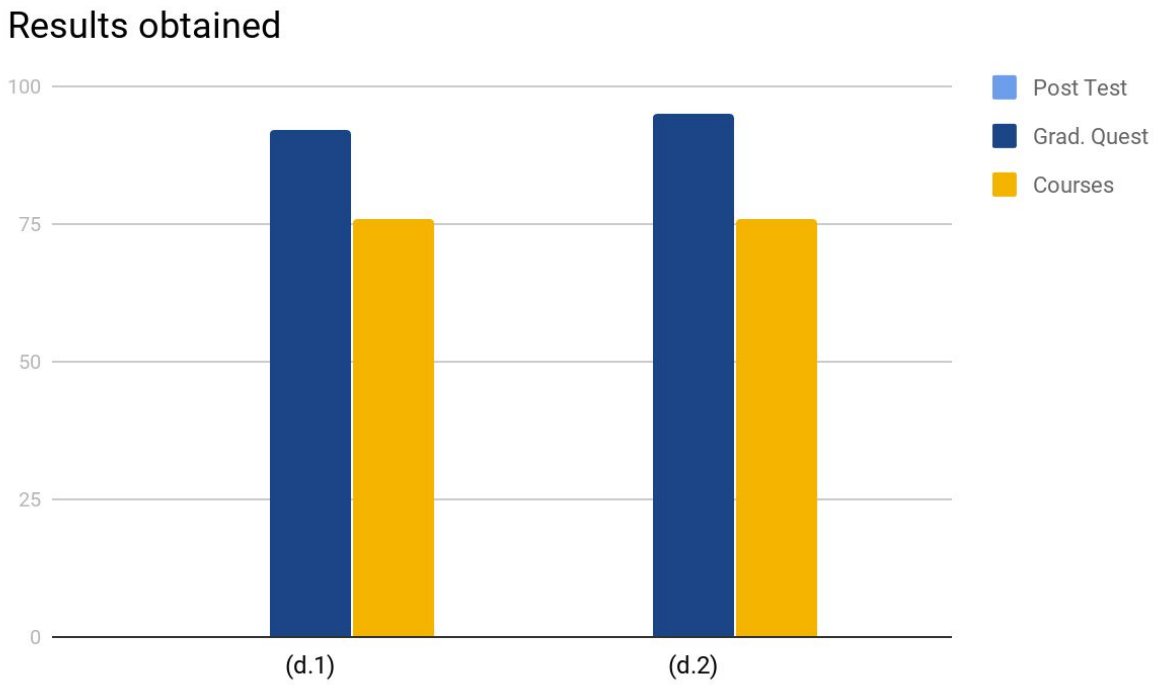
The PIs for this outcome changed during this cycle. However, some of the previous one remained. Therefore, PI (c.1) is similar but not equal to PI (3.d) from last assessment cycle. The results obtained from the post-test were not satisfactory and were way beyond the 84% that was previously obtained. We have to analyze if the problems were directly an impact of the changes made in the post-test. However, after analyzing the data obtained from the courses we can conclude that this outcome was met, even though, there was also a decreased in the data analyzed from the courses when compared with the last assessment cycle. Students have increased their confidence level when analyzing the data obtained from the graduate questionnaire from last assessment cycle to this one for PI (c.2). The increased was a 16%. Moreover, PI (c.3) obtained mostly the same confidence level of satisfaction.

Conclusions and Recommendations

The AAC concluded that this outcome is partially met. The committee recommends:

- Recommendation and reflection: Why students of the IS program did obtain a lower grade on the test than those in the CS program for PI (c.1)? It is an open question we need to analyze. This problem needs to be addressed.
- Reflection: Performance Indicator (c.3) should be met in next assessment cycle. It is envision that all the students would have an experience using Junit in the upcoming years. Students would understand the difference between the type of testings they are performing.

Outcome d: An ability to function effectively on teams to accomplish a common goal



This outcome is measured by two performance indicators. This PIs are the following:

(d.1) Evaluate a given problem within a team environment

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 92%). On SICI 4037-Data Communications students evaluate each other after finalizing the course project. They filled out the Group Skills rubric. After analyzing this instrument we found out that more than 76% of the students gave their peers the highest grade (4/4) in the skills of: problem solving, work attitude and *ability of* working with others. Therefore, the AAC concluded that the achievement level of this PI was met.

(d.2) Perform duties assigned when working on team

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 95%). We use the same instrument as the previous PI. After analyzing this instrument we found out that more that around 76% of the students gave their peers the highest grade (4/4) in the skills of: contributions and quality of the work. Therefore, the AAC concluded that the achievement level of this PI was met.

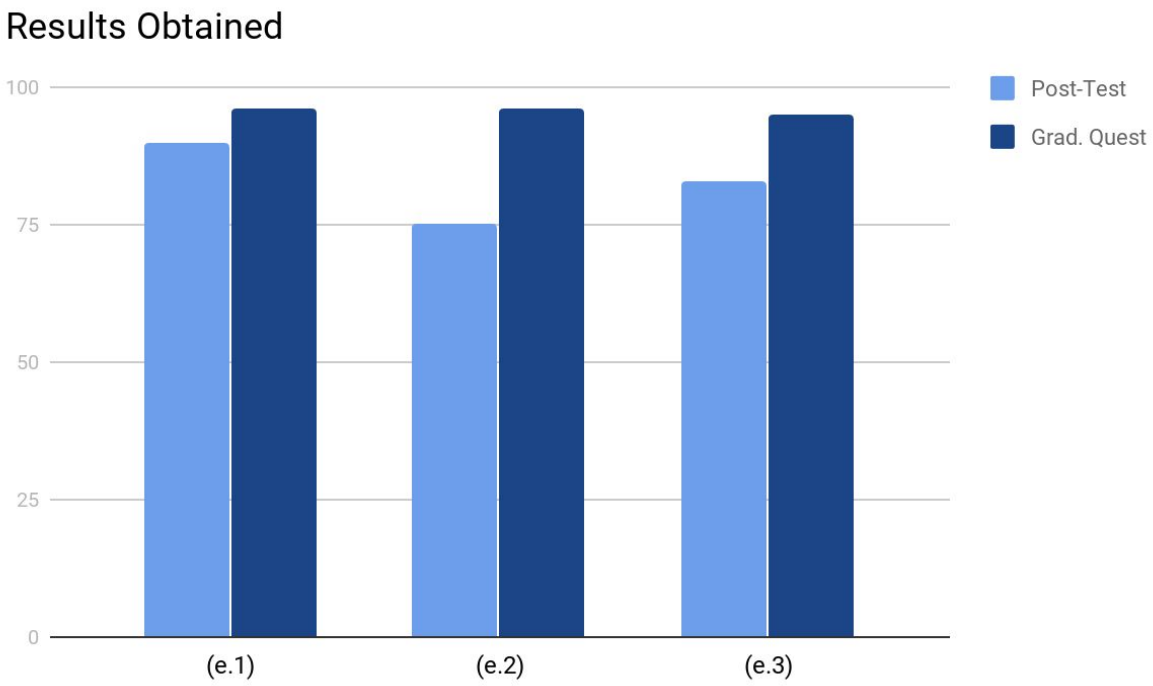
Previous Cycle Comparison

This outcome was trim down from 4 to 2 performance indicators for this assessment cycle. Curiously, we obtained the same figures for PI (d.1) and PI(d.2) on current and previous assessment cycles.

Conclusions and Recommendations

This outcome was met.

Outcome e: An understanding of professional, ethical, legal, security and social issues and responsibilities



This outcome is measured by three performance indicators. This PIs are the following:

(e.1) Evaluate the ethical implications of an issue in the computing discipline

On the post-test 90% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 96%. Therefore the AAC concluded that the achievement level for this PI was met.

(e.2) Evaluate the social impact of a given computing technology

On the post-test 75% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 96%. Therefore the AAC concluded that the achievement level for this PI was met.

(e.3) Recognize the responsibilities inherent to the profession

On the post-test 83% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 95%. Therefore the AAC concluded that the achievement level for this PI was met.

Previous Cycle Comparison

The AAC recommended last time the inclusion of a course named COTI 3XXX *Information, Computes and Society Seminar.* This course was named COTI 3305 Computing Ethics and Society to our curriculum for both emphasis areas (programs). This improved the attainment level of this outcome.

Comparing last assessment cycle with this one we can see that for PI (e.1) there was a 6% of difference between last cycle and this one (96% - 90%). The AAC sees this difference as negligible. Also the students gave this indicator a strong satisfactory grade. Also, during this cycle all efforts were focused into improving this particular outcome. The questions on the post-test were revised. Also, a new course was introduced to focus on this outcome.

On the post-test 75% of the students answered the questions related to PI (e.2) correctly. There were no questions for this PI on the previous version of the post-test. Also, on previous cycle, the AAC use data from the courses to assess this PI. Last Cycle, the AAC classified this PI as developing. This cycle has been classified as satisfactory. There has been a 4% of increased on the achievement level. Also, during this cycle all efforts were focused into improving this particular outcome.

On the post-test 83% of the students answered the questions related to PI (e.3) correctly. There were no questions for this PI on the previous version of the post-test. The AAC used data from the courses to assess this PI on previous cycle. This PI has been has been classified as satisfactory.

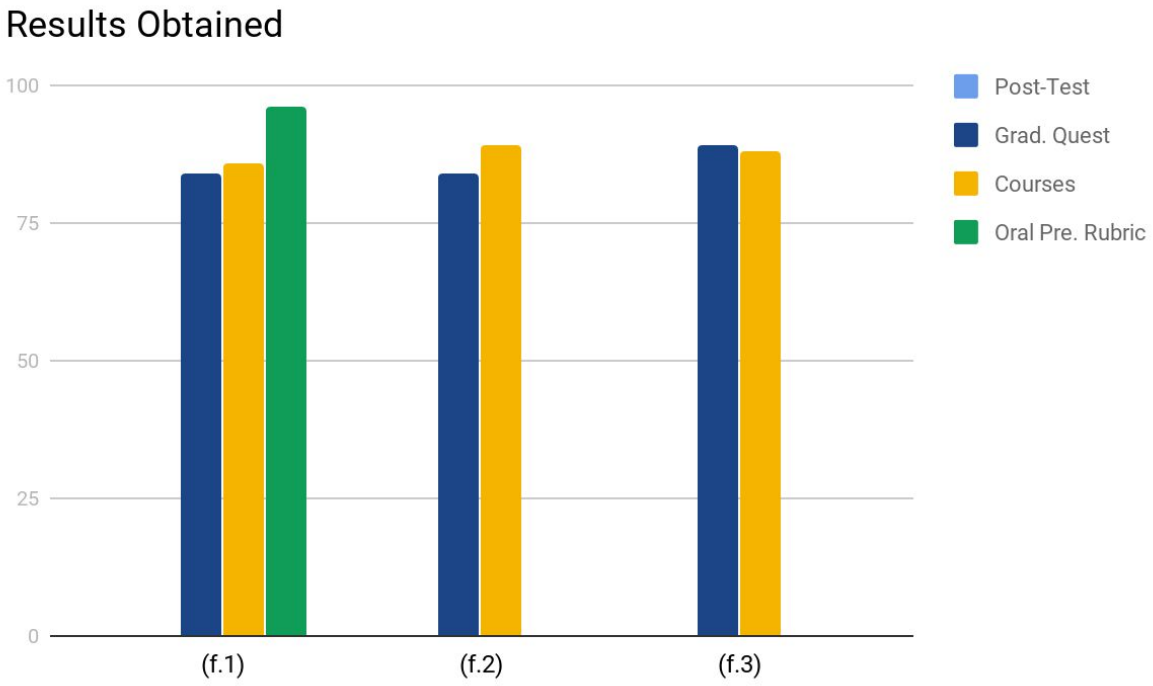
Conclusions and Recommendations

The addition of the 2 credit course COTI 3305 Computing Ethics and Society focuses on ethics and legal issues related to computing. The objective of this course is to increase the ethical awareness of our students.

The AAC comments:

- Reflection: Our curriculum has a course in Information Security and we don't have a performance indicator or a question in the test related to that. We need to add at least one PI that measures security aspects.
- Reflection: The legal aspects that are related to the field are covered in the course COTI 3305. However, there is no question in the post-test that address this. We need to add at least one PI or one question that measures this part of the outcome.

Outcome f: An ability to communicate effectively with a range of audiences.



This outcome is measured by three performance indicators. This PIs are the following:

(f.1) Present different topics both orally and/or in writing

All the students that completed the graduate questionnaire gave this indicator a grade of B (an average of 84%). The AAC decided to analyze the grade obtained from the first row of the rubric for the SICI 4019 Computer Architecture Term Paper. Moreover, the AAC decided to analyze the grade obtained from the oral presentation rubric from the SICI 4037 Data Communication course. The average grade obtained analyzing the first rubric was 17.22/20.00 = 86 %. The average obtained by analyzing the oral presentation rubric is 95.8%. Therefore the AAC concluded that the achievement level for this PI was met.

(f.2) Explain technical concepts using the correct terminology

All the students that completed the graduate questionnaire gave this indicator a grade of B (an average of 84%). The AAC decided to analyze the rubric for the SICI 4019 Computer Architecture Term Paper specifically the 4th row. The average grade obtained analyzing this row was 17.85/20.00 = 89 %. Therefore the AAC concluded that the achievement level for this PI was met.

(f.3) Display knowledge of technical report writing

All the students that completed the graduate questionnaire gave this indicator a grade of B (an average of 89%). The AAC decided to analyze the overall grade obtained from the rubric used for the SICI 4019 Computer Architecture Term Paper. The mean grade obtained after analyzing the data was 88% (87.7). Therefore the AAC concluded that the achievement level for this PI was met.

Previous Cycle Comparison

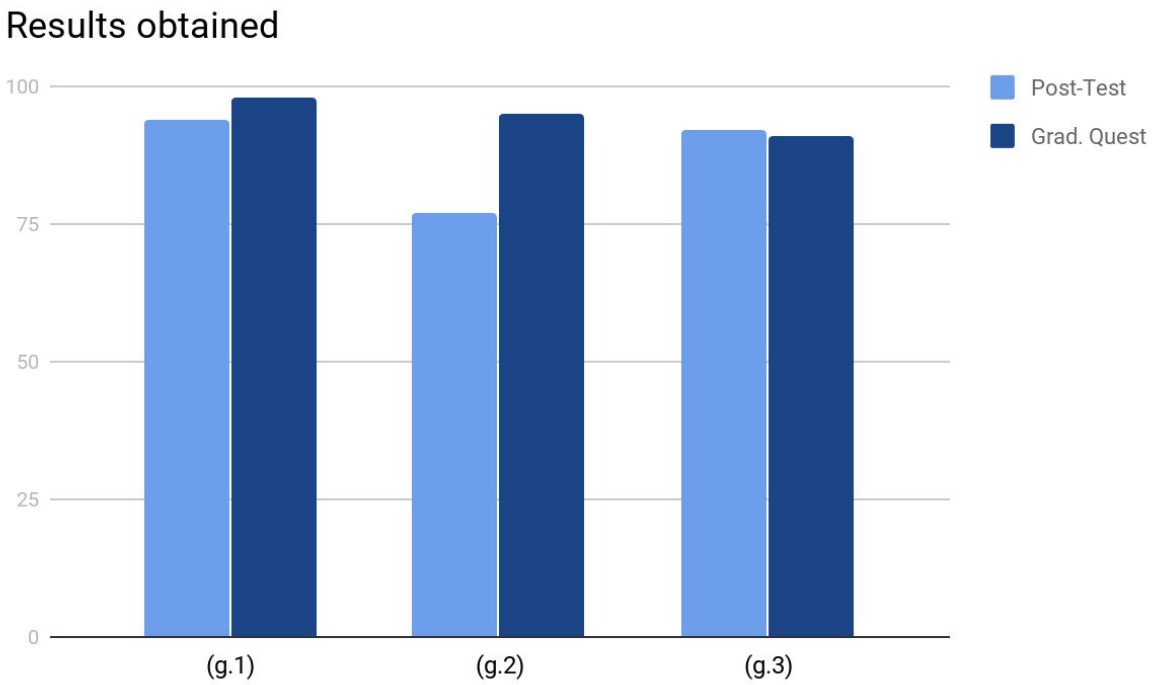
Comparing last assessment cycle with this one we can see that for PI (f.1) almost stay the same (86%-87%). However, there was an increase of around 12% on the grade obtained by analyzing the data obtained from the course. Moreover, for PI (f.3) students show a slight decrease of 4% on this PI. Last time the SICI 4038 Capstone Course was used to measure this PI. This time we use SICI 4019 Computer Architecture. An 88% and a 92% are strong satisfactory levels.

Conclusions and Recommendations

The AAC decided that this outcome was met. However the AAC make the following comments:

- Remark: This outcome was met solidly on this cycle,however, we have analyzed the attainment of this outcome using mostly the data obtained from the SICI 4019 Term Paper and the SICI 4037 Final Project presentation. The outcome is An ability to communicate effectively *with a range of audiences*. Does the data obtained from these courses is sufficient? Where is that range of audience? Does professors and students is sufficient? Would it be better to measure this outcome in SICI 4038 our capstone course? The AAC must reflect about this

Outcome g: An ability to analyze the local and global impact of computing on individuals, organizations, and society.



This outcome is measured by three performance indicators. This PIs are the following:

(g.1) Understand computational or technological advances and their impact on individuals, organizations and society.

On the Post-test 94% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 98%. Therefore the AAC concluded that the achievement level for this PI was met.

(g.2) Recognize the global and local impact of a given technology.

On the Post-test 77% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 95%. Therefore the AAC concluded that the achievement level for this PI was met.

(g.3) Be aware of the state of the art in computing technology.

On the Post-test 92% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 91%. Therefore the AAC concluded that the achievement level for this PI was met.

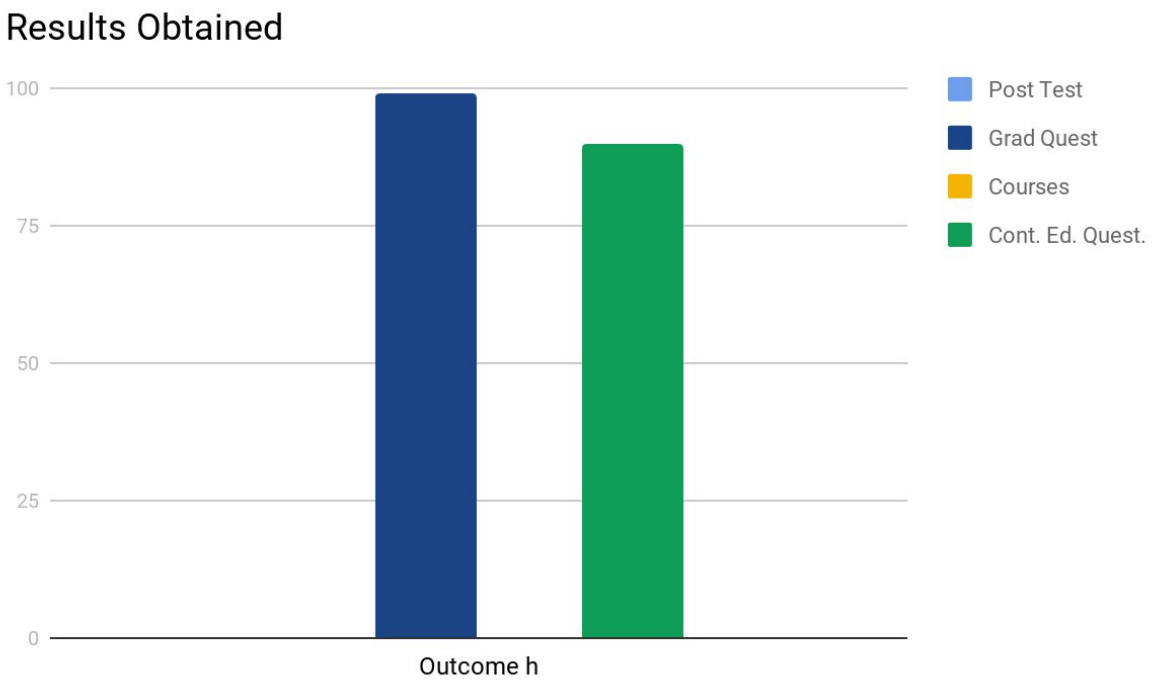
Previous Cycle Comparison

The performance indicators for this outcome received a major overhaul from previous cycle to this cycle. Therefore, each PI cannot be compared directly.

Conclusions and Recommendations

The AAC decided that this outcome was met.

Outcome h: Recognition of the need for an ability to engage in continuing professional development



This outcome does not have any performance indicator. We are measuring the outcome directly.

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 99%). All the students take a lecture on *Continuous Education and Career Paths* on their Capstone Course (SICI 4038). They also answer a questionnaire about this outcome during this course. After

analyzing the data 90% recognize the need to engage in continuing professional development. Therefore, the AAC concluded that the achievement level for this PI was met.

Previous Cycle Comparison

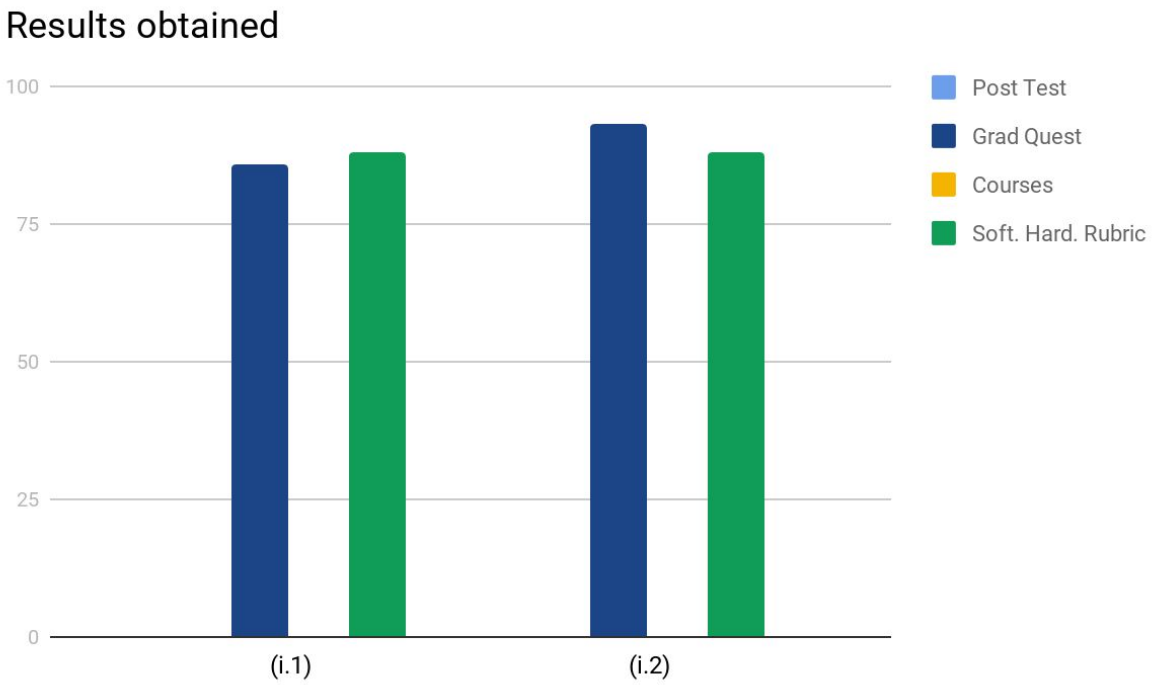
The AAC recommended developing suitable instruments to measure this outcome during the last cycle. Also, the AAC recommended the revision of all the performance indicators that were part of this outcome. The PIs were eliminated. Therefore, there was no way to compare each PI. However, a lecture on Continuous Education and Career Paths as a requisite of the SICI 4038 (Capstone course) was added to measure this outcome. Also, the students take a questionnaire after this lecture.

Conclusions and Recommendations

This outcome was met. Special attention was taken to this outcome during this cycle.

- Reflection: Around 15% of the students indicated that they plan to pursue graduate school. The AAC needs to analyze if this is too low. A discussion with the department needs to be schedule to analyze this. Also some professors have raised a concern that this lecture should be given earlier.

Outcome i: An ability to use current techniques, skills and tools necessary for computing practices.



This outcome is measured by two performance indicators. This PIs are the following:

(i.1) Use hardware and software tools currently available

Around 86% of the students used hardware and software tools currently available. This was obtain by looking at the results from the Rubric to Evaluate Software and Hardware Tools. All the students that completed the graduate questionnaire gave this indicator a grade of B (an average of 88%).

(i.2) Use current techniques and skills in the practice of the profession.

Around 93% of the students use current techniques and skills during the courses. This was obtained by looking at the results from the Rubric to Evaluate Software and Hardware Tools. All the students that completed the graduate questionnaire gave this indicator a grade of B (an average of 88%).

Previous Cycle Comparison

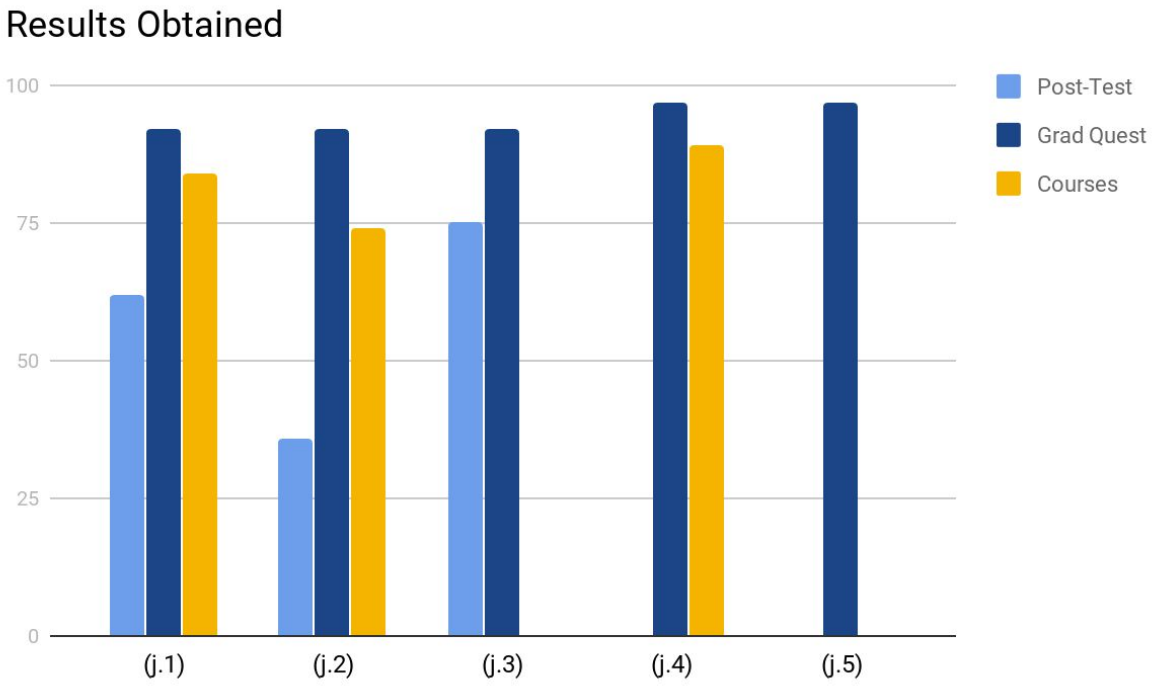
Current cycle percentages are even higher than on the previous cycle. Also the attainment level for this outcome was satisfactory.

Conclusions and Recommendations

Although this outcome was met:

- Recommendation: The only experience our students have is on the environment of Microsoft Windows. It is our knowledge there are students that own MAC or have installed linux on their laptops. However, this is not the norm. Some faculty have a concern on this matter. The department has set as a goal to add a Linux partition in every hard drive of the PCs of our laboratories. However, this task have not been completed. The AAC recommends that this goal should be set with a definitive deadline.

Outcome j: An understanding of processes that support the delivery and management of information systems within a specific application environment.



This outcome is measured by five performance indicators. This PIs are the following:

(j.1) Analyze the information flow in an organization.

On the Post-test 62% of the students answered the questions related to this PI correctly. However, all the students that completed the graduate questionnaire gave this indicator a grade of A in average 92%. Since there is a discrepancy we have to dig further and analyze data from the courses. The AAC decided to analyze data obtained from COTI 4430 Project Management class. The attainment level of this performance indicator on this course was 84%. Therefore, the AAC classified this PI as met.

(j.2) Understanding the process operations within an organization.

On the Post-test 36% of the students answered the questions related to this PI correctly. However, all the students that completed the graduate questionnaire gave this indicator a grade of A in average 92%. Since there is a discrepancy we have to dig further and analyze data from the courses. The AAC decided to analyze data from the courses COTI 4430 Project Management and SICI 3211 Information Systems

Fundamentals. On average, students achieve a 74% on this PI, a satisfactory grade. Therefore, the AAC classified this PI as developing.

(j.3) An ability to discern between transactional-processing system, management information system, and decision support system.

On the Post-test 75% of the students answered the questions related to this PI correctly. All the students that completed the graduate questionnaire gave this indicator a grade of A in average 92%. Therefore the AAC concluded that the achievement level for this PI was met.

(j.4) Recommends viable solutions using computer systems as main solution

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 97%). The AAC analyze data obtained from COTI 4430 Project Management and SICI 4038 Capstone Course. On average, students achieve 89% on this PI. Therefore, the AAC concluded that the achievement level of this PI was met.

(j.5) Construct an Information System

All the students that completed the graduate questionnaire gave this indicator a grade of A (an average of 97%). After analyzing the projects that have been develop for SICI 4038 (Capstone Course) the AAC concluded that this performance indicator was met. Students have develop projects that span from Inventory Systems to Law Offices Management Systems. Therefore, the AAC concluded that the achievement level of this PI was met.

Previous Cycle Comparison

There was an improvement in all areas of PI (j.1) even with low scores in the post-test. Last time the average grade obtained from the post test was 40%. Now, the grade has increase to 62%. Also there was an increase of 6% on the data analyze from COTI 4430. However, for PI (j.2) there was not a substantial increase whatsoever (32% to 34%) using the results from the post-test. A similar trait happens when analyzing the data from the courses (73% to 74%). For PI (j.3) there has been a decrease of -14% in the results obtained from the post-test (89% to 75%). For PI(j.4) the attainment level grew up approximately 11%

Conclusions and Recommendations

The AAC classifies this outcome as partially met.

- Recommendation: The post-test results for performance indicator (j.2) were too low. After analyzing the data obtained from the courses the results indicated that this PI was developing. The AAC recommends to reinforce PI (j.2) on the courses. On last assessment cycle we

recommended *the creation of assessment instruments to measures the indicator* in *Business Administration courses*. The truth is that we never created them. We need to study if the low results on the post-test results in poor drafting of the post-test. Also, the committee recommends to reinforce PI (j.2) on the courses that are exclusive for the IS program.

- Recommendation: Also, the committee recommends a revision of the questions presented on the post-test for PI (j.2)

- Recommendation: The AAC recommends that this outcome should be reinforce at all levels on the courses that the IS students take exclusively. Taking special care in PIs (j.2), (j.3), and (j.4).