Performance Indicators as Basis for Students' Performance Improvement

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Abstract *This study examines the application of performance indicators in assessing and improving student outcomes within a College of Computer Studies. By adopting a descriptive approach, the research scrutinizes Final Exam results and project evaluations from students enrolled in BS Computer Science over the academic years 2014-2018. The focus is specifically on the PIs related to the students' ability to apply knowledge of computing and mathematics appropriate to the discipline, as well as their skills in analysing problems and defining computing requirements. Utilizing methods such as percentage and weighted mean for data analysis, the findings highlight the effectiveness of PIs in identifying areas for instructional improvement. Through this assessment, the study provides valuable insights into how academic programs can leverage PLS to enhance learning outcomes and academic instruction.*

Keywords – *Performance Indicators, Student Outcomes, Educational Assessment, Instructional Improvement, Computing Education*

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INTRODUCTION

All Higher Education Institutions (HEIs) including private HEIs, State Universities and Colleges (SUCs), and Local Universities and Colleges (LUCs) with existing BSCS programs are required to shift to an outcomes-based approach under PSG and must inform the Commission of such shift. Hence, SUCs and LUCs should likewise strictly adhere to the provisions in these policies, standards and guidelines. However, the HEIs are allowed to design curricula suited to their context and missions provided that they can demonstrate that the same leads to the attainment of the required minimum set of outcomes, albeit by a different direction. In the same vein, they have latitude in terms of curriculum delivery and in terms of specification and deployment of human and physical resources as long as they can show that the attainment of the program outcomes and satisfaction of program educational objectives can be assured by the alternative means they propose.

As such Bachelor of Science in Computer Science program includes the study of computing concepts and theories, algorithmic foundations, and new developments in computing. The program therefore aims to prepare the students to design and create algorithmically complex software and develop new and effective algorithms for solving computing problems. It prepares students to acquire skills and disciplines required for designing, writing and modifying software components, modules and applications that comprise software solutions. The program goals point to graduates who are expected to become globally competent, innovative, and socially and ethically responsible computing professionals engaged in life-long learning endeavors. The BSCS program is to express the minimum set of graduate outcomes and those common to the discipline are further mapped into the expanded graduate outcomes specific to their sub-discipline. Graduates of SUCs must, in addition, have the competencies to support "national, regional and local development plans", such graduate attributes can be assessed through set of performance indicators provided that the institution may enhance the minimum performance indicators using an industry or globally accepted reference competency inventory.

To monitor, a curriculum map was developed, where Student Outcomes together with each Performance Indicator must be aligned with course requirements. Performance indicators are concrete and measurable performances that students must meet as indicators of achievement. These indicators are used to measure the effectiveness of teaching and learning and to identify areas for improvement. Performance indicators that can be used as a basis for students' performance refer to the level of academic performance of students, such as test scores, grades, and other measures of learning outcomes. By focusing on these

indicators, teachers can help students achieve their full potential and improve their overall performance. Each student outcome can have a performance target or performance indicator associated with it. Performance indicators are specific, measurable demonstrations of achievement that identify the performances required to meet the outcome and against which other performances can be compared. In this study, the performance target of 80% was required for each student's outcome and performance indicator.

OBJECTIVES OF THE STUDY

This study primarily aims to identify the relevance of the listed performance indicator to the student outcomes of the course; to prepare students for summative assessments and to provide against end-of-course standards of performance or measurement of competence assessments including final exams and individual or group projects. Determine which professional courses need necessary action for improvement.

MATERIALS AND METHODS

Research Design

The study utilized a descriptive approach as it tried to examine and understand a current phenomenon. As such it was used to describe systematically and accurately the facts and characteristics of a given population or area of interest which in this case are the blended learning approach. It provided a comprehensive and accurate picture of a population or phenomenon, identified trends and patterns, compared, and contrasted different populations or phenomena, and generated hypotheses for future research.

Research Respondents

The study was conducted at the Lyceum of the Philippines University-Batangas, College of Computer Studies. The BS Computer Science Curriculum SY 2012-2016 was used. Data were gathered from Final Exam and individual or group projects of the students who were enrolled in BS Computer Science taking professional courses during the Academic Year 2014-2018. With the performance target for each performance indicator, it determined which courses need improvement. All data were collected, sorted, and presented and interpreted from the Final examination and individual or group projects submitted by the assigned professors.

Data Gathering Procedure

To facilitate data-gathering, Final Exam of all Professional courses were chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covered all the learning required in each identified course strategy. The time collection of data covered from regular semesters of the Academic Year 2014 -2018.

Data Analysis

To interpret the data effectively, the researcher employed Percentage and Weighted Mean. Percentage was used to determine part or portion about its whole. This reflected the population or census as to how many would yield to the questions being asked. The weighted average is an average in which each observation in the data set is assigned or multiplied by a weight before summing to a single average value. In this process, each quantity to be averaged is assigned a weight that determines the relative importance of each quantity. Weightings are the equivalent of having that many like items with the same value involved in the average.

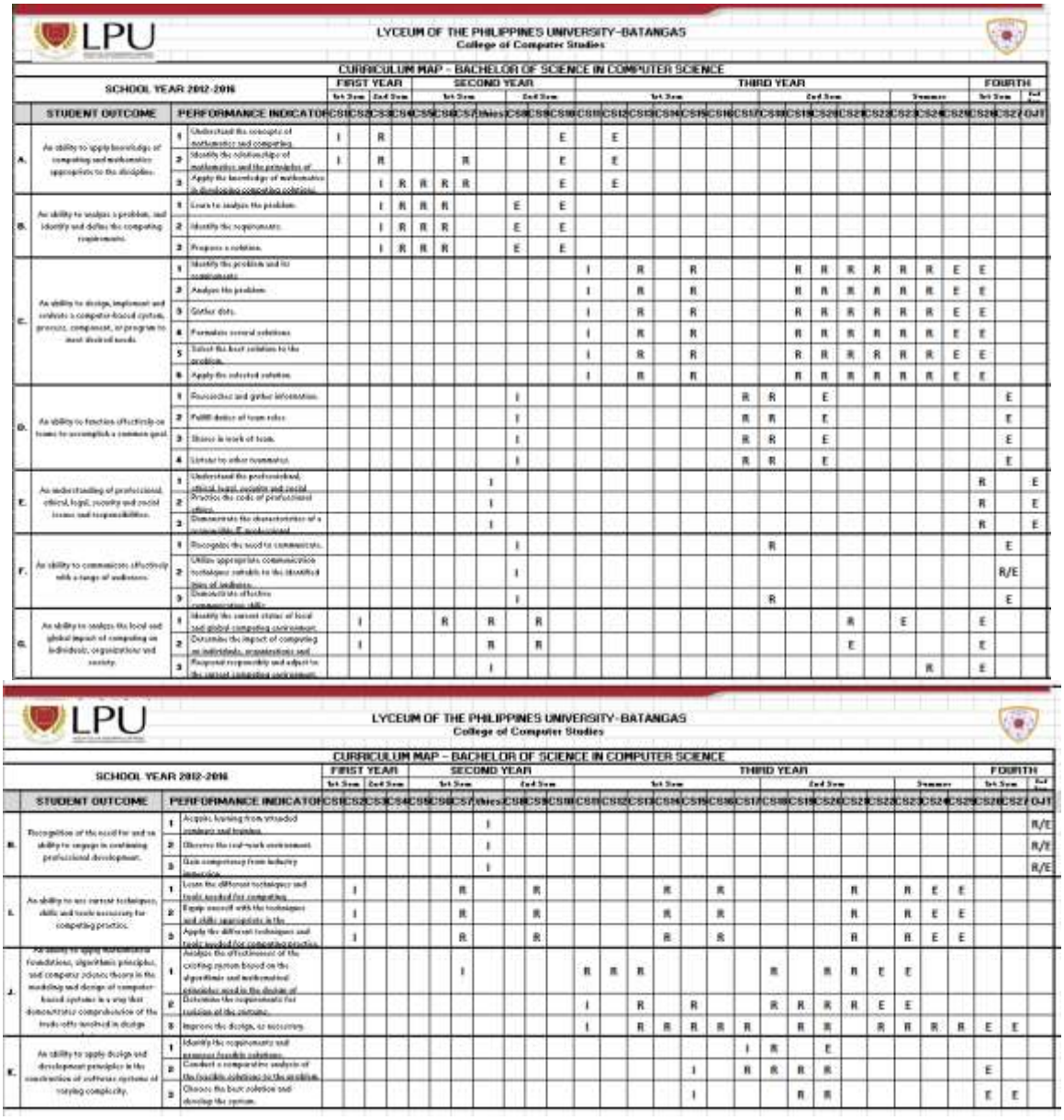
Ethical Consideration

The author saw no possible violation of norms and ethics in relation to determining preference of learning modalities. However, the author exercised due care in handling confidential information especially in obtaining the information of the respondents to avoid violation of privacy.

RESULTS AND DISCUSSION

The study of Asih et.al [1] published in the Journal of Strategy and Performance Management conducts a systematic review of research on Key Performance Indicators (KPIs). This means they analyze a wide range of prior studies to understand how KPIs are used and their impact on managing performance indicators. likely defines KPIs and explores their role in translating broad strategies into specific, measurable goals. that might delve into various frameworks and approaches for developing and implementing KPIs within different courses.

The following table shows the results of each Student's outcomes and their performance indicator.



LYCEUM OF THE PHILIPPINES UNIVERSITY-BATANGAS
College of Computer Studies

CURRICULUM MAP - BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SCHOOL YEAR 2012-2016

	STUDENT OUTCOME		PERFORMANCE INDICATOR	FIRST YEAR 1st Sem	FIRST YEAR 2nd Sem	SECOND YEAR 1st Sem	SECOND YEAR 2nd Sem	THIRD YEAR 1st Sem	THIRD YEAR 2nd Sem	THIRD YEAR Summer	FOURTH 1st Sem	FOURTH 2nd Sem
A.	An ability to apply knowledge of computing and mathematics appropriate to the discipline.	1	Understand the concepts of mathematics and computing.	I R		E	E					
		2	Identify the relationship of mathematics and the principles of computing.	I R		E	E					
		3	Apply the knowledge of mathematics in developing computing solutions.	I R R R R		E	E					
B.	An ability to analyze a problem, and identify and define the computing requirements.	1	Learn to analyze the problem.	I R R R		E	E					
		2	Identify the requirements.	I R R R		E	E					
		3	Propose a solution.	I R R R		E	E					
C.	An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.	1	Identify the problem and its requirements.					I R R	R R R R R R E	E		
		2	Analyze the problem.					I R R	R R R R R R E	E		
		3	Gather data.					I R R	R R R R R R E	E		
		4	Formulate several solutions.					I R R	R R R R R R E	E		
		5	Select the best solution to the problem.					I R R	R R R R R R E	E		
		6	Apply the selected solution.					I R R	R R R R R R E	E		
D.	An ability to function effectively on teams to accomplish a common goal.	1	Researches and gather information.			I		R R	E		E	
		2	Fulfill duties of team roles.			I		R R	E		E	
		3	Shares in work of team.			I		R R	E		E	
		4	Listens to other members.			I		R R	E		E	
E.	An understanding of professional, ethical, legal, security and social issues and responsibilities.	1	Understand the professional, ethical, legal, security and social issues and responsibilities.				I				R	E
		2	Practice the code of professional ethics.				I				R	E
		3	Demonstrate the characteristics of a responsible IT professional.				I				R	E
F.	An ability to communicate effectively with a range of audiences.	1	Recognize the need to communicate.				I		R		E	
		2	Utilize appropriate communication techniques/ methods to the identified type of audience.				I				R/E	
		3	Demonstrate effective communication skills.				I		R		E	
G.	An ability to analyze the local and global impact of computing on individuals, organizations and society.	1	Identify the current status of local and global computing environment.	I	R	R	R			E	E	
		2	Determine the impact of computing on individuals, organizations and society.	I		R	R		E		E	
		3	Recognize responsibility and adjust to the current computing environment.			I				R	E	

LYCEUM OF THE PHILIPPINES UNIVERSITY-BATANGAS
College of Computer Studies

CURRICULUM MAP - BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SCHOOL YEAR 2012-2016

	STUDENT OUTCOME		PERFORMANCE INDICATOR	FIRST YEAR 1st Sem	FIRST YEAR 2nd Sem	SECOND YEAR 1st Sem	SECOND YEAR 2nd Sem	THIRD YEAR 1st Sem	THIRD YEAR 2nd Sem	THIRD YEAR Summer	FOURTH 1st Sem	FOURTH 2nd Sem
H.	Recognition of the need for and an ability to engage in continuing professional development.	1	Acquire learning from virtualized simulation and training.				I					R/E
		2	Observe the real-work environment.				I					R/E
		3	Gain competency from industry immersion.				I					R/E
I.	An ability to use current techniques, skills and tools necessary for computing practice.	1	Learn the different technology and tools needed for computing.	I		R	R	R	R	R E E		
		2	Equip oneself with the techniques and skills appropriate in the	I		R	R	R	R	R E E		
		3	Apply the different techniques and tools needed for computing practice.	I		R	R	R	R	R E E		
J.	An ability to apply knowledge of computing fundamentals, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design.	1	Analyze the effectiveness of the existing system based on the algorithmic and mathematical principles used in the design of			I		R R R	R R E E			
		2	Determine the requirements for revision of the system.					I R R	R R R R E E			
		3	Improve the design, as necessary.					I R R R R R	R R R R R E E			
K.	An ability to apply design and development principles in the construction of software systems of varying complexity.	1	Identify the requirements and propose feasible solutions.					I R	E			
		2	Conduct a comparative analysis of the feasible solutions to the problem.					I R R R	R		E	
		3	Choose the best solution and develop the system.					I	R R		E E	

Figure 1. Curriculum Map of Bachelor of Science in Computer Science SY 2012-2016.

Table 1. Student Outcome (a) An ability to apply knowledge of computing and mathematics appropriate to the discipline."

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Understand the concepts of mathematics and computing.	CS 1, CS 3, CS 10,CS 12	Final Exam	CS 12	First Sem,2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Identify the relationship of mathematics and principles of computing.	CS 1, CS 3, CS 7, CS 10, CS 12	Final Exam	CS 12	First Sem,2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Apply the knowledge of mathematics in developing computing solutions.	CS 3,CS 4,CS 5,CS 6,CS 7, CS 10, CS 12	Final Exam	CS 12	First Sem,2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee

The figure includes Student Outcomes and Performance Indicators corresponding to the 29 Professional Courses from CS 1 to OJT. The indicators

I for Introduction, R for Reinforce and E for Emphasize are positioned strategically to indicate the sequencing of learning based on the Course Intended Learning Outcomes and Performance Indicator.

The whole section of BSCS was assessed. This represents 100% of the population where summative data for Indicator 1 were collected from CS1 – CS Fundamentals, CS 3- Digital Design, CS 10- CCNA1 Networking 1 and CS 12- Discrete Structures, for Indicator 2 were collected from CS1 – CS Fundamentals, CS 3- Digital Design, CS 7- Operating System, CS 10- CCNA1 Networking 1 and CS 12- Discrete Structures, and for Indicator 3 were collected from CS 3- Digital Design, CS 4- Computer Programming, CS 5- Data Structures, CS 6- Computer Organization, CS 7- Operating System, CS 10- CCNA1 Networking 1 and CS 12- Discrete Structures.

For all indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all the indicators, 81% was obtained as the average percentage grade achieved by the students who demonstrated each of the criteria for lecture component. According to Namoun, et.al, [2] the study concentrates on student learning outcomes, which goes beyond just grades, it emphasizes the potential of data mining and learning analytics in predicting student performance using various techniques. It highlights the effectiveness of specific models and the metrics used to evaluate their success to understand the effectiveness of various intelligent techniques used to predict how well students will perform.

Based on the results, the following actions are taken.

The assessment results were reviewed by the faculty members who are responsible for teaching the strategies. Since the students met the performance target for each indicator, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection. In the study of Albreiki et.al., [3] investigates the use of machine learning (ML) techniques to predict student performance in educational settings. The study explores how ML can be utilized to predict student performance and identify students who might be struggling. The research confirms that various ML techniques are effective in predicting student performance and dropout rates. Generally, the review highlights the potential of machine learning as a valuable tool in educational settings to predict student performance and provide timely support mechanisms.

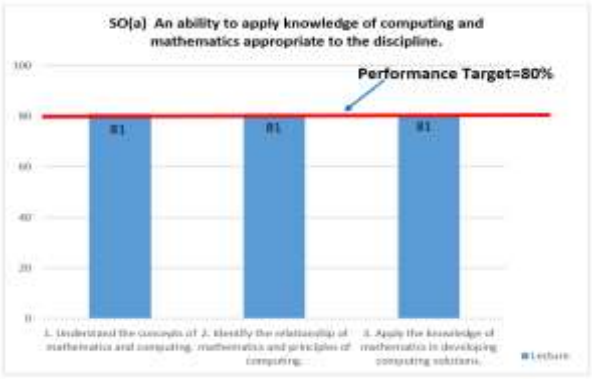


Figure 1. SO(a) An ability to apply knowledge of computing and mathematics appropriate to the discipline

Table 2. Student Outcome (b) An ability to analyze a problem, and identify and define the computing requirements

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Learn to analyze the problem.	CS3, CS4, CS5, CS6, CS8, CS10	Final Exam	CS 10	Second Semester, 2015-2016	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Identify the requirements.	CS3, CS4, CS5, CS6,CS 8 CS10	Final Exam	CS 10	Second Semester, 2015-2016	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Propose a solution.	CS3, CS4, CS5, CS6, CS 8, CS10	Final Exam	CS 10	Second Semester, 2015-2016	Department Chair and Faculty Adviser	CCS Curriculum Committee

For the findings, again, the whole section of BSCS was assessed. This represents 100% of the population where summative data were collected from CS3 – Digital Design, CS 4-Computer Programming, CS5-Data Structures, CS6- Computer Organization and CS10 – Networking 1, for Indicators 1-3. For all indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all the indicators, 80% was obtained as the average percentage grade achieved by the students who demonstrated each of the criteria for the lecture component and 81% for the laboratory component.

For its action, the assessment results were reviewed by the faculty members who are responsible for teaching the strategies. Since the students met the performance target for each indicator, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection. Since 80% was obtained as the average percentage by the students, faculty members agreed and decided to review the course strategy used in the lecture component for indicators 1-3, to continually improve the program's activity in this area. According to Azzam et. al., [4] discussed the importance of establishing measurable indicators to assess student learning outcomes. This is important for educational institutions to maintain and improve the quality of teaching and learning. The study specifically focuses on rubric-based assessment systems, which outline clear criteria for evaluating student performance. The study also included both direct assessments, such as exams, and indirect assessments, such as surveys distributed to students. This allowed for a more comprehensive analysis of student learning outcomes.

Figure 2. SO(b) An ability to analyze a problem and identify and define the computing requirements

Table 3. Student Outcome (c) An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1.Identify the problem and its requirements.	CS 11, CS 13, CS 15,CS 19, CS 20, CS 21,CS22, CS23, CS24,CS 25,CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
2.Analyze the problem.	CS 11, CS 13, CS 15,CS 19, CS 20, CS 21,CS22, CS23, CS24,CS 25,CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
3.Gather data.	CS 11, CS 13, CS 15,CS 19, CS 20, CS 21,CS22, CS23, CS24,CS 25,CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
4.Formulate several solutions.	CS 11, CS 13, CS 15,CS 19,	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

	CS 20, CS 21,CS22, CS23, CS24,CS 25,CS 26					
5.Select the best solution to the problem.	CS 11, CS 13, CS 15,CS 19, CS 20, CS 21,CS22, CS23, CS24,CS 25,CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
6.Apply the selected solution.	CS 11, CS 13, CS 15,CS 19, CS 20, CS 21,CS22, CS23, CS24,CS 25,CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

The results show that the whole section of BSCS was assessed. This represents 100% of the population where summative data were collected from CS 11- Algorithms, CS 13- Object Oriented Programming, CS 15- CCNA2 Networking 2, CS 19-CCNA 3- Networking 3, CS 20- Software Engineering, CS 21- Game Development and Mobile Application Development, CS 22- Automata and Language Theory, CS 23- Gaming Flatform Frameworks and Android Application Development, CS 24- Advanced Game Development and Advanced Mobile Application Development, CS25 – Modeling and Simulation and CS26 – Networking 4, for Indicators 1-6. For all indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all the indicators, 83% was obtained as the average percentage grade achieved by the students who demonstrated each of the criterion for the lecture component and 91% for the laboratory component which shows that students perform better in the laboratory activities.

As for the action, the assessment results were reviewed by the faculty members who are responsible for teaching the strategies. Since the students met the performance target for each indicator, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection."

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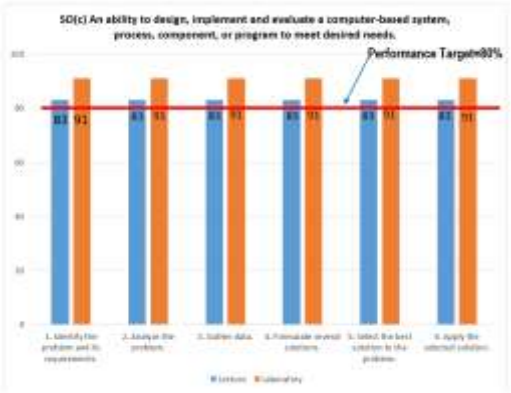

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Figure 3. Student Outcome (c) An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.

Table 4. Student Outcome (d) An ability to function effectively on teams to accomplish a common goal

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Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1.Researches and gather information.	CS8, CS17, CS 18, CS 20, CS26	Final Exam/ Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
2.Fulfill duties of team roles.	CS8, CS17, CS 18, CS 20, CS26	Final Exam/ Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
3.Shares in work of team.	CS8, CS17, CS 18, CS 20, CS26	Final Exam/ Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
4.Listens to other teammates.	CS8, CS17, CS 18, CS 20, CS26	Final Exam/ Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

Results indicate that the whole section of BSCS was assessed. This represents 100% of the population where summative data were collected from CS 8- System Analysis and Design, CS 17- Project Management, CS 18- Special Project 1, CS 20-Software Engineering, CS 26- CCNA Networking 4 and CS 27- Special Project 2, for Indicators 1-4. For all indicators, the Final Exam and Special Project Grading Sheet were chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy while the Special Project Grading Sheet was used to assess the student's performance as completed by the faculty/panellist. For all the indicators, 86% was obtained as the average percentage grade achieved by the students who demonstrated each of the criterion for the lecture component.

As for the actions, because the students met the performance target for each indicator, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection."

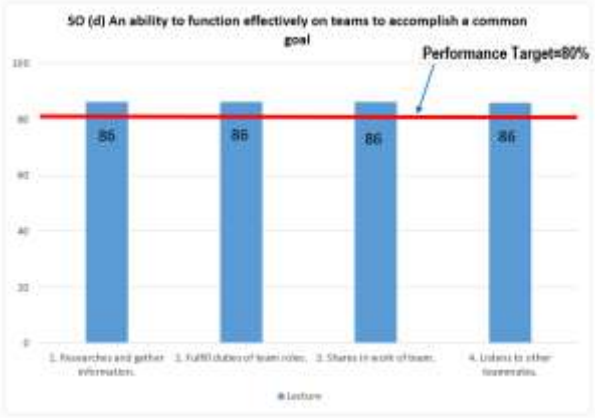


Figure 4. Student Outcome (d) An ability to function effectively on teams to accomplish a common goal.

Table 5. Student Outcome (e) An understanding of professional, ethical, legal, security and social issues and responsibilities

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Understand the professional, ethical, legal, security and social issues.	Ethics 2, CS 26,OJT	Revalida	OJT	Second Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Practice the code of professional ethics.	Ethics 2, CS 26,OJT	Revalida	OJT	Second Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Demonstrate the characteristics of a responsible IT professional.	Ethics 2, CS 26,OJT	Revalida	OJT	Second Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

The data show that the whole section of BSCS was assessed. This represents 100% of the population where summative data were collected from Ethics 2- Professional Ethics for CS, CS 26- CCNA 4 Networking 4 and OJT – On-the-Job Training, for Indicators 1-3. Fo all indicators, the Revalida was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. Students needed to complete the OJT Revalida form and the assigned faculty then checked their responses and were given points based on rubrics. For all the indicators, 90% was obtained as the average percentage grade achieved by the students who demonstrated each of the criterion.

The assessment results were reviewed by the faculty members who were responsible for teaching the strategies. Since the result is very high for all the indicators, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection.

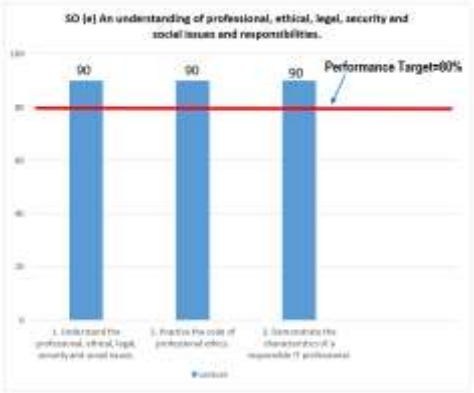


Figure 5. Student Outcome (e) An understanding of professional, ethical, legal, security and social issues and responsibilities.

Table 6. Student Outcome (f) An ability to communicate effectively with a range of audiences."

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Recognize the needs to communicate.	CS8, CS 18, CS 27	Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Utilize appropriate communication techniques suitable to the identified type of audience.	CS8, CS27	Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Demonstrate effective communication skills.	CS8, CS 18, CS 27	Special Project Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

Results reveal that summative data for Indicators 1 and 3 were collected in CS 8- System Analysis and Design, CS 18- Special Project 1 and CS27 – Special Project 2, for Indicator 2 were collected from CS 8- System Analysis and Design and CS 27- Special Project 2. In this course, students needed to present their thesis project in front of a set of panelists from the college. The scoring rubrics to assess the student's performance were completed by the faculty/panelist. All or 100% of the class met the performance target for all indicators with a percentage of 86%.

Therefore, assessment results were reviewed by the faculty members who are teaching the courses assigned for SO (f). Since 100% of the students met the performance target, faculty agreed not to take any further action."

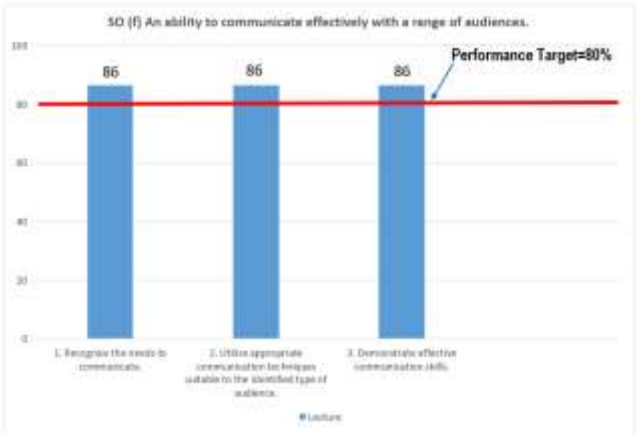


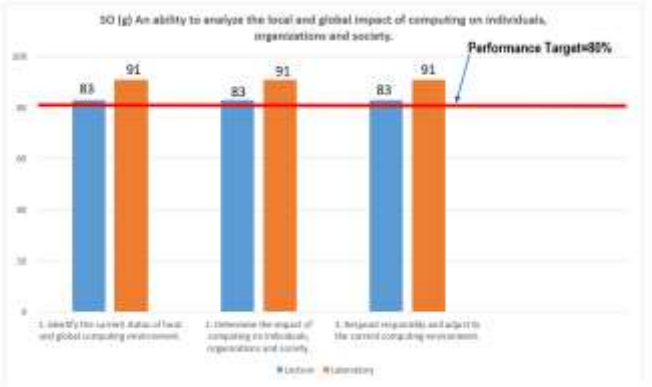
Figure 6. Student Outcome (f) An ability to communicate effectively with a range of audiences.

Results show that for the summative assessment, the decision was made to focus on the faculty member's direct assessment for all indicators. Summative data for Indicator 1 were collected from CS 2- Computer Applications, CS 6- Computer Organizations, Ethics 2- Professional Ethics for CS, CS 9- Multimedia Technologies, CS 21- Game Development and Mobile Application Development, CS 23- Gaming Platform Framework and Android Application Development, and CS 26- CCNA Networking 4, for Indicator 2 were collected from CS 2- Computer Applications, Ethics 2- Professional Ethics for CS, CS 9- Multimedia Technologies, CS 21- Game Development and Mobile Application Development and CS 26- CCNA Networking 4, for Indicator 3 were collected from Ethics 2- Professional Ethics for CS, CS 24- Advanced Game Development and Advanced Mobile Application Development and CS 26- CCNA Networking 4. For all indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all the indicators, 83% was obtained as the average percentage grade achieved by the students who demonstrated each of the criteria for the lecture component and 91% for the laboratory component.

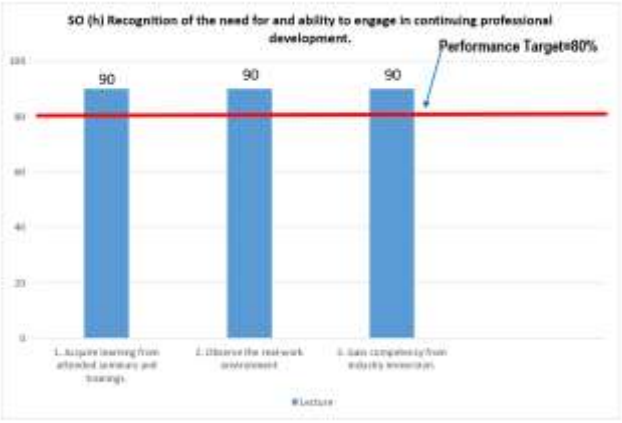
As for the actions, the assessment results were reviewed by the faculty members who are teaching the courses assigned for SO (g). Faculty members were satisfied that the program was achieving the desired outcome, and it was recommended not to make any changes at this time."

Table 7. Student Outcome (g) An ability to analyze the local and global impact of computing on individuals, organizations and society."

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Identify the current status of local and global computing environment.	CS2, CS6,Ethics2, CS9,CS21,CS23,CS26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Determine the impact of computing on individuals, organizations and society.	CS2, Ethics2, CS9,CS21,CS26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Respond responsibly and adjust to the current computing environment.	Ethics2, CS 24, CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee



"Figure 7. Student Outcome (g) An ability to analyze the local and global impact of computing on individuals, organizations and society.



"Figure 8. Student Outcome (h) Recognition of the need for and ability to engage in continuing professional development."

The whole section of BSCS was assessed. This represents 100% of the population where summative data were collected from Ethics 2- Professional Ethics for CS and OJT- On-the-Job Training. The revalida was used as the primary assessment method. Students need to accomplish the OJT Revalida form and the assigned faculty then checked their responses and were given points based on the set rubrics. All or 100% of students met the performance target for all indicators with a very high percentage of 90%.

Based on the analysis of the results, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection. Faculty members were satisfied that the program was achieving the desired outcome, and it was recommended not to make any changes at this time.

Table 8. Student Outcome (h) Recognition of the need for and ability to engage in continuing professional development."

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Acquire learning from attended seminars and trainings.	Ethics 2,OJT	Revalida	OJT	Second Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Observe the real-work environment.	Ethics 2,OJT	Revalida	OJT	Second Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Gain competency from industry immersion.	Ethics 2,OJT	Revalida	OJT	Second Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

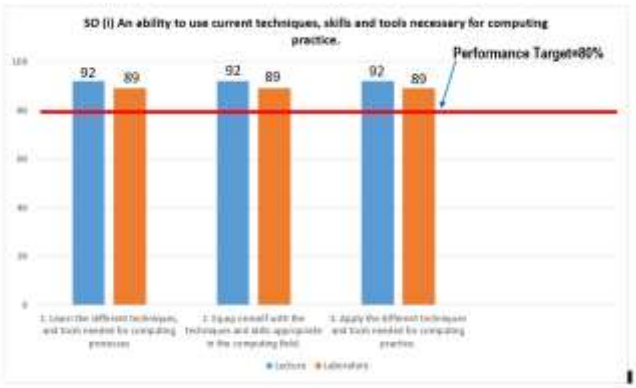
Table 9. Student Outcome (i) An ability to use current techniques, skills and tools necessary for computing practice

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Learn the different techniques, and tools needed for computing processes.	CS2, CS7, CS9,CS14, CS16,CS21, CS23, CS24, CS 25	Final Exam	CS25	Summer, 2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee
2. Equip oneself with the techniques and skills appropriate in the computing field	CS2, CS7, CS9,CS14, CS16,CS21, CS23, CS24, CS 25	Final Exam	CS25	Summer, 2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee
3. Apply the different techniques and tools needed for computing practice.	CS2, CS7, CS9,CS14, CS16,CS21, CS23, CS24, CS 25	Final Exam	CS25	Summer, 2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee

The whole section of BSCS was assessed. This represents 100% of the population where summative data were collected from CS 2- Computer Applications, CS 7- Operating Systems, CS 9- Multimedia Technologies, CS 14- Database Management System, CS 16-Human Computer Interaction, CS 21- Game Development and Mobile Application Development, CS 23- Gaming Platform Frameworks and Android

Application Development, CS 24- Advanced Game Development and Advanced Mobile Application Development, and CS 25- Modeling and Simulation, for Indicators 1-3. For all indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all the indicators, 92% was obtained as the average percentage grade achieved by the students who demonstrated each of the criteria for lecture component and 89% for the laboratory component.

As for the actions, the assessment results were reviewed by the faculty members who were responsible for teaching the strategies. Since the results are very high for all the indicators and 100% of the students met the performance target for each indicator, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection."



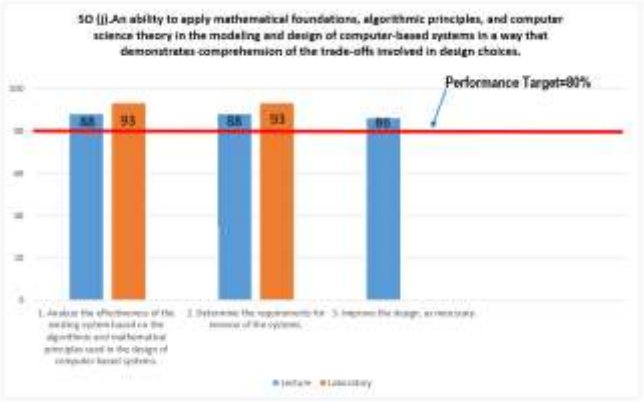
"Figure 9. Student Outcome (i) An ability to use current techniques, skills, and tools necessary for computing practice.

Table 10. Student Outcome (j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices."

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1.Analyze the effectiveness of the existing system based on the algorithms and mathematical principles used in the design of computer-based systems.	CS7,CS 11,CS12,CS13, CS18,CS 20, CS 21, CS 22, CS23	Final Exam	CS23	Summer, 2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee
2.Determine the requirements for revision of the systems	CS11, CS13, CS15, CS19, CS 19, CS20, CS21, CS22,CS23	Final Exam	CS23	Summer, 2016-2017	Department Chair and Faculty Adviser	CCS Curriculum Committee
3.Improve the design, as necessary.	CS11, CS13, CS14,CS15, CS16, CS17, CS19, CS20, CS22,CS23,CS 24, CS25,CS26, CS27	Final Exam	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	CCS Curriculum Committee

For the summative assessment, the decision was made to focus on the faculty member's direct assessment for all indicators. Summative data for Indicator 1 were collected from CS 7- Operating Systems, CS 11- Algorithms, CS 12- Discrete Structures, CS 13- Object Oriented Programming, CS 18- Special Project 1, CS 20- Software Engineering, CS 21- Game Development and Mobile Application Development, CS 22- Automata and Language Theory and CS 23- Gaming Flatform Frameworks and Android Application Development, for Indicator 2 were collected from CS 11- Algorithms, CS 13- Object Oriented Programming, CS 15- CCNA 2- Networking 2, CS 18- Special Project 1,CS 19- CCNA 3 Networking 3, CS 20-Software Engineering, CS 21- Game Development and Mobile Application Development, CS 22- Automata and Language Theory and CS 23- Gaming Flatform Frameworks and Android Application Development, and Indicator 3 were collected from CS 11- Algorithms, CS 13- Object Oriented Programming, CS 14- Database Management System, CS 15- CCNA 2- Networking 2, CS 16-Human Computer Interaction, CS 17- Project Management, CS 19- CCNA 3 Networking 3, CS 20-Software Engineering, CS 22- Automata and Language Theory and CS 23- Gaming Flatform Frameworks and Android Application Development, CS 24- Advanced Game Development and Advanced Mobile Application Development, CS 25- Modeling and Simulation, CS 26- CCNA 4- Networking 4 and CS 27- Special Project 2. For all the indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all the indicators, the average percentage grade achieved by the students who demonstrated each of the criteria, both for the lecture and laboratory components, met the performance target.

Based on the analysis of the results, the faculty decided not to take further action but to monitor student progress through the next cycle of data collection. Faculty members were satisfied that the program was achieving the desired outcome, and it was recommended not to make any changes at this time. However, faculty agreed to re-evaluate the targets and review the performance indicators."



"Figure 10. Student Outcome (j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices."

Table 11. Student Outcome (k) An ability to apply design and development principles in the construction of software systems of varying complexity."

Performance Indicator	Strategies	Assessment Method(s)	Source of Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results
1. Identify the requirements and propose feasible solutions.	CS17, CS19, CS 20	Final Exam	CS20	Second Semester, 2016-2017	Department Chair and Faculty Adviser	DCS Curriculum Committee
2. Conduct a comparative analysis of the feasible solutions to the problem.	CS 15, CS 17, CS 18, CS 19, CS 20, CS 26	Final Exam	CS26	First Semester, 2017-2018	Department Chair and Faculty Adviser	DCS Curriculum Committee
3. Choose the best solution and develop the system.	CS 15, CS 19, CS 20, CS 26	Final Exam/ Special Project 2 Grading Sheet	CS27	First Semester, 2017-2018	Department Chair and Faculty Adviser	DCS Curriculum Committee

For the summative assessment, the decision was made to focus on the faculty member's direct assessment for all indicators. Summative data for Indicator 1 were collected from CS 17- Project Management, CS 18- Special Project 1, and CS 20- Software Engineering and from CS 15- CCNA Networking 2, CS 17- Project Management, CS 18- Special Project 1, CS 19- CCNA 3-Networking 3, CS 20- Software Engineering and CS 26-CCNA Networking 4 for Indicator 2, and for Indicator 3 data were collected from CS 15- CCNA 2-Networking 2, CS 19- CCNA 3- Networking 3, CS 20- Software Engineering and CS 26- CCNA 4-Networking 4. For all indicators, the Final Exam was chosen as the primary assessment method and the assigned faculty completed the scoring rubrics. The final exam was selected as a method of assessment since it covers all the learning required in each identified course strategy. For all indicators, the obtained average percentage grade was achieved by the students who demonstrated each of the criterion for the laboratory component and lecture component are above the target.

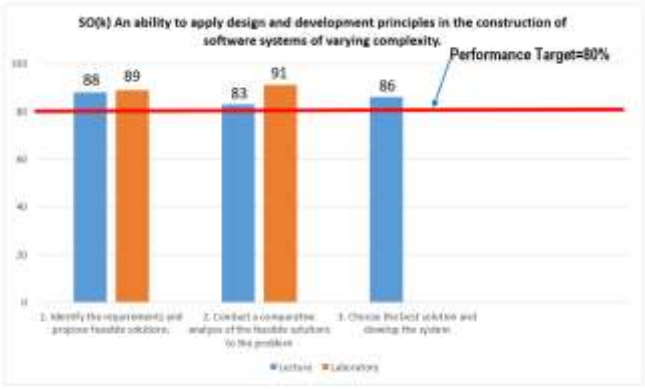


Figure 11. Student Outcome (k) An ability to apply design and development principles in the construction of software systems of varying complexity."

The assessment results were reviewed by the faculty members who are teaching the courses assigned for SO (k). Faculty members were satisfied that the program was achieving the desired outcome, and it was recommended not to make any changes at this time. According to (Giersch et.al, 2021), the study explored how well school performance indicators predict a student's success in college. Researchers looked at data from public high schools in North Carolina, focusing on standardized test scores (proficiency) and student improvement (growth) as performance indicators. Their findings showed that both proficiency and growth scores were somewhat useful in predicting college achievement, particularly for students taking a mix of regular and honors classes. Interestingly, the study found that a student's academic track (regular, honors, etc.) was an even stronger predictor of college success than the school performance indicators. This suggests that school indicators, while helpful, may not capture the full picture of how well a school prepares students for college.

CONCLUSION AND RECOMMENDATION

The study's evaluation of performance indicators within a Computer Science program revealed their importance in diagnostic assessment and pedagogical enhancement for student learning. The structured analysis of summative assessment data showed that while the performance targets of 80% were largely met, specific student outcomes concerning the application of computational knowledge and problem analysis could benefit from further development. Additionally, the alignment of teaching strategies with desired learning outcomes and the identification of instructional areas needing attention were facilitated through the use of performance indicators.

Based on the findings, it is recommended that faculty members refine learning outcomes to be flexible, student-centered, and directly beneficial to students' personal and professional lives. Moreover, educators should design activities that enable students to meet and exceed the targeted performance indicators, utilizing these assessments to inform continuous improvement strategies. Both deans and faculty members should employ these indicators to provide constructive feedback and effectively prepare students for summative evaluations, thus ensuring the educational program's alignment with both current academic standards and the student's future needs.

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