



Research Article

Evaluation and effectiveness of student's awareness on outcome-based education perception and implementation in teaching/learning activities a cross-sectional study

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ABSTRACT

Outcome Based Education evaluates students' knowledge, behavior, and practical abilities. It is crucial for determining learning goals, changing courses, pinpointing learning gaps, boosting motivation and engagement, and fostering ongoing educational progress. Outcome-Based Education implementation is enhanced and the learning experience is fostered by the use of data from student evaluations. This research investigates students' knowledge of Outcome-Based Education and analyzes how demographic factors like age and gender affect their understanding. The data was analyzed using descriptive statistics and the chi-square test (version 4.2.3) in R software after 250 pupils responded to the survey. 65.86% of pupils are acquainted with outcome-based education. Students who were older or had completed NPTEL courses were more informed. According to these findings, age and further coursework have an impact on one's understanding of outcome-based education, which may inform methods for putting Outcome-Based Education into practice. This is one of the first studies to examine how demographic variables, such as age and NPTEL course completion, affect the awareness of Outcome-based education. Student understanding of Outcome-Based Education can be evaluated to gain insightful knowledge about its practical efficacy. Student viewpoints have a significant influence on the development of learning strategies that are student-centered, relevant, and successful. Including pupils in the evaluation process helps to improve the overall quality of education as well as promote ongoing development.

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INTRODUCTION

Conventional education system, with its focus on standardized teaching, Rote recitation and repeated testing may not effectively educate pupils for the difficulties of the twenty-first century. To deal with this, India has adopted outcome-based education (OBE), which emphasizes the results students should achieve after completing their course. Problem-solving, practical knowledge, career preparation, and critical thinking are given priority in OBE. India aims to improve its global competitiveness by aligning academic achievement with the line of business needs and international norms. The method of giving students the essential and required skills, accreditation, and flexible opportunities to succeed in today's competitive world. Implementation of this method seeks to overcome the shortcomings of traditional education and educational methods and foster economic development. OBE is mainly focused on initiating and putting forward learning objectives and developing curricula, pedagogy, and assessments to fulfill those objectives. As the technology is advancing expeditiously, not only developing just technical proficiency help graduates, but also effective communication, problem-solving and other skills. Traditional teaching methods are insufficient for developing these skills, making OBE a crucial strategy for preparing students for the future. In recent decades, scholars worldwide have placed significant emphasis on a system known as outcome-based education. In this framework, the facilitator first defines the desired objectives or competencies that students must evince, which generally cover the combinations of skills, and enhances the mindset related to the topic and develops expertise. Once when these outcomes are established, the curriculum designed aligns to help students to achieve them with the instructional strategies, regular practices and evaluation methods accordingly. Unlike the traditional educational systems, which emphasize the teacher-led guidance, self-directed learning in outcome-based education. The new approach is set in such a way that clear goals are set and are also accomplished by the students by the end of each course upon graduation. In this system, professors function as facilitators who enhance students' learning experiences. Outcome-Based Education is implemented by including Course Outcomes (COs), Program Outcomes (POs), and Program Educational Objectives (PEOs) into the curriculum. The technique of Outcome-Based Education (OBE) is constantly changing. OBE has two primary goals: first, to set precise learning outcomes around which the entire academic system is built, and second, to provide conditions and opportunities that encourage students to accomplish these planned results. The current paper intends to emphasize and analyze the many writers' contributions to OBE, as well as to suggest a theoretical framework for its application. With universities increasingly embracing OBE to align with international standards, recent educational reforms have sought to depart from conventional teaching methods.

The implementation of this transition in Nigeria's educational system has drawn significant academic attention and debate. Key elements of Outcome-Based Education (OBE) have been explored by Borsoto et al. [1], Hansen et al. [2], and Towers et al. [3], that includes the method of assessing students' learning and altering educational practices to stimulate outcome-based approaches.

Harden et al. [4], studied the efficacy of Outcome-Based Education (OBE), while Mukhopadhyay and Smith [5] examined its broader effects. Tan et al. [6] discussed how novel instructional strategies have to be integrated into OBE, while Asis [7] focused on specific student learning difficulties in the OBE framework. Taken together, these research offers helpful suggestions and instructions to the educators and students on how the OBE principles can be implemented into practice. Additionally, studies by Caguimbal et al. [8], Deneen et al. [9], Cook et al. [10], and Laguador et al. [11] looked at the knowledge and interests that students had in OBE. Their research was also focused on principles, instructional strategies, methodological frameworks and the opportunities it offers, including the challenges faced. Collectively, these studies highlight the importance of OBE in contemporary education, underscoring its effects, implementation challenges, and strategies for intensifying teaching and learning results. By 2014, Borsoto et al. [1] and Laguador et al. [12] investigated the gap between knowledge and practice in Outcome-Based Education (OBE) implementation among engineering educators at LPU, highlighting the extent of implementation and its utility within the engineering and technology department. The theoretical perspectives and current tasks within OBE frameworks were provided by Shaheen [13], it offers insights into ongoing discussions and practical outcomes. Vennila J et al. [14] studied how COVID-19 pandemic affected academic achievement, which also highlighted how teachers and students felt about modern pedagogical methods, particularly the use of R programming. This research underscores the ongoing debate around OBE, the challenges of implementing OBE and the prerequisite to modify the educational practices to keep up with changing conditions and technological breakthroughs.

While OBE is implemented broadly, there is still research going on on how aware the students are of it. Hardly many studies have looked at how variables like age, interest and involvement in additional courses like NPTEL affect students' level of understanding and improvements, while the majority of them have concentrated on its implementation. This study aims to close the gap by looking at the effect of demographic factors on students' awareness and understanding of OBE. Based on this literature review, potential research gaps may be identified in ongoing trends and challenges within education.

1. It can be less sufficient research to determine how students retain and learn knowledge based on their OBE paradigm. It can provide useful information

on the long-term applicability of OBE in the development of learning and skill mastery.

2. Despite the fact that OBE has the potential to foster equity and inclusion in that it caters to the different learning needs of all learners, there has been very little research on its impact on marginalized and underrepresented groups, including special needs learners, ELL learners, and socio-economically disadvantaged learners. More research should be done to investigate how OBE can be used to cater to the needs of all kids in order to eradicate inequalities in education.
3. Despite growing recognition of the significance of teachers' professional development in the implementation of OBE, there has been very little research on effective strategies for teachers in the process. Further research should be conducted to examine the forms of teachers' training that can be most helpful in assisting teachers to comprehend the concepts of OBE.
4. As evaluation forms an integral part of the process in OBE, there has been continuous debate and confusion about the best methodologies for evaluating student learning outcomes in an OBE system. Further research should be conducted to examine the validity, reliability, and fairness of different forms of evaluation in achieving the desired results in student learning.
5. The effectiveness of OBE can differ substantially depending on the institutional culture, policy context, and socio-cultural setting. There is a need for research on these variables to assess their impact on the formulation and implementation of OBE.
6. In view of the increasing use of technology for various educational pursuits, there is a need for study on its possible integration with OBE for more effective teaching and learning experiences, evaluation and feedback mechanisms, and individualized learning paths.

Recent developments and advancements in Microgrid (MG) and Optimal Power Flow (OPF) have greatly improved the efficiency and reliability of modern energy infrastructure. Similarly, Optimal Power Flow calculations have improved in terms of precision and efficiency with the inclusion of recent advances in optimization techniques, i.e., Convex Relaxation and Machine Learning. These advances are important in improving energy efficiency and are an example of how technology is helping to solve the challenges posed by modern issues in power management. Future developments in this area are expected to improve these systems even further, resulting in improved energy solutions.

By addressing these gaps in research, we hope to improve our exploration of the intricacies and complexities of Outcome-Based Education (OBE) and improve our efforts in ensuring its effectiveness and its positive impacts

on students' learning outcomes. To achieve this objective, this research aims to generate findings that will be useful in developing strategies on how to effectively promote OBE and improve students' engagement and learning outcomes and experiences. The objectives of this study are as follows: First, it aims to develop and validate a questionnaire that will measure students' awareness of and perceptions about OBE implementation in teaching and learning activities; and second, it aims to investigate students' knowledge and attitudes about OBE. It should allow professionals to take well-informed decisions about the best way of integrating OBE and establishing an environment of continuous improvement throughout the process of teaching and learning.

MATERIALS AND METHODS

Data for this research was acquired using a survey questionnaire designed for descriptive analysis. The primary objectives of the questionnaire were to assess students' knowledge and attitudes towards outcome-based education (OBE) and their commitment to implementing OBE in teaching and learning activities Rhaffor et al., [15].

Sample

The survey included 250 pupils in all, and G*Power 3.1 was used to calculate the sample size. Using the convenience sampling method, the participants were chosen for the study. To identify the significant effects, the statistical validity was preserved thanks to this sample size's ability. A questionnaire was meticulously designed and validated to measure the Students' understanding, views and awareness of OBE. Validation involved expert evaluation, focus group discussions and a pilot study. From this 5% to 10% of the data collected and used for finding reliability analysis. Data for the pilot survey and primary analysis were collected using convenience sampling techniques. Descriptive statistics and Chi-square tests were used to analyze the data. R software(version 4.2.3) was used to perform all the statistical analyses.

Phase of Study

Phase I: Baselines identify the sample size.

Phase II: Questionnaire developed, validated, and circulated to respondents with their consent using focus group discussions.

Phase III: Data analyzed using R open sources (4.2.3. version)

Phase IV: Result and importance discussed.

Phase V: Conclusion.

DATA ANALYSIS

A systematic approach was adopted in the development and validation of the questionnaire, which includes steps like literature study, FGD, expert evaluation, and

pilot study, among others. Informed consent was obtained from all the participants before they were involved in the study, and the study was approved by the institutional ethics committee of Kongunadu Arts and Science College in Coimbatore, Tamil Nadu, India. In order to validate the questionnaire, a study was done using a survey research design with a convenience sampling approach. There were two main parts to the study: Section A and Section B. Section A was used to obtain background information about the participants, while Section B was further divided into three parts: dedication to OBE implementation, teaching and learning, and awareness of OBE, as shown in Table 1. The questionnaire attempted to measure the awareness and attitude of students towards OBE using a 5-point Likert scale ranging from 1: Strongly Disagree to 5: Strongly Agree. The data was then statistically analyzed using R programming. The questionnaire was also administered in English language.

Reliability Assessment

The questionnaire was also validated using a cross-sectional study, and data was collected from 20 participants using a convenience sampling technique. The internal consistency of the entire questionnaire was also verified using Cronbach alpha coefficient, and it was found to be 0.85, indicating a very high level of internal consistency. The independent alpha coefficients for the components of the questionnaire were 0.92, 0.85, and 0.83, indicating an excellent level of internal consistency. According to Sekaran (2000), internal consistency reliability greater than 0.6 is good, greater than 0.7 is very good, and greater than 0.9 is exceptional.

Content and face validity were assessed through expert judgment and focus group discussions (FGD). Construct validity was carried out through factor analysis, and item analysis was done to assess construct validity based on the filled-out forms. A correlation matrix was constructed to measure the level of association among the items. Sampling adequacy was assessed using Kaiser-Meyer-Olkin (KMO), and it scored 0.947. Bartlett's sphericity test was carried out and gave a chi-square of 23.56 with a p-value of 0.001. Factor analysis was done based on Kaiser's criteria and varimax rotation to assess domain validity. Twenty-one items were analyzed, and they were confirmed through factor analysis.

Table 1. Data verbal interpretation guide

Weight	Verbal Interpretation
5	Strongly agree
4	Agree
3	Neutral
2	Disagree
1	Strongly disagree

RESULTS AND DISCUSSION

Frequency and percentage were used to assess students' knowledge of Outcome-Based Education (OBE) and their attitudes toward its implementation. Using the well-structured questionnaire the data were collected, analyzed and interpreted based on the guidelines outlined in Table 2.

Descriptive statistical analysis were analysed and mentioned in Table 2 and Figure 1, From the results, it observed that, majority of the respondents are lies in between the age group of 20-23 (52%), form that most of them are female respondents (60.6%) to compare the male respondents. Most of participantents are educated in PG level (55.9%) with having science background (54.7%).

Measures of Association Between Demographic Data And Awareness of OBE (Knowledge and Based Questions)

The results in Table 3 and Figure 2 show how students know about their colleges Outcome-Based Education strategy. This varies based on a lot of things. We used the Chi-square test to see how students answers relate to things like gender, age what they are studying. If they finished NPTEL courses. We found differences when it comes to age and finishing NPTEL courses. Older students and those who finished NPTEL courses understand the colleges Outcome-Based Education strategy. They also know more about how the college calculates Program Educational Objectives and Program Outcomes. The Outcome-Based Education strategy and these factors are important, for helping students understand things better. The colleges Outcome-Based Education strategy is affected by these factors.

Table 2. Descriptive statistics of demographic data-based OBE based students' knowledge questionnaire

Characteristics	Frequency (Percentage)
Age group	
17-20	102 (40.2%)
20-23	132 (52%)
23-26	19 (7.5%)
26-29	1 (0.4%)
Gender	
Male	100 (39.4%)
Female	154 (60.6%)
Level of study	
UG	109 (42.9%)
PG	142 (55.9%)
Diploma	3 (1.2%)
Branch	
Arts	101 (39.8%)
Science	139 (54.7%)
Engineering & Technology	14 (5.5%)

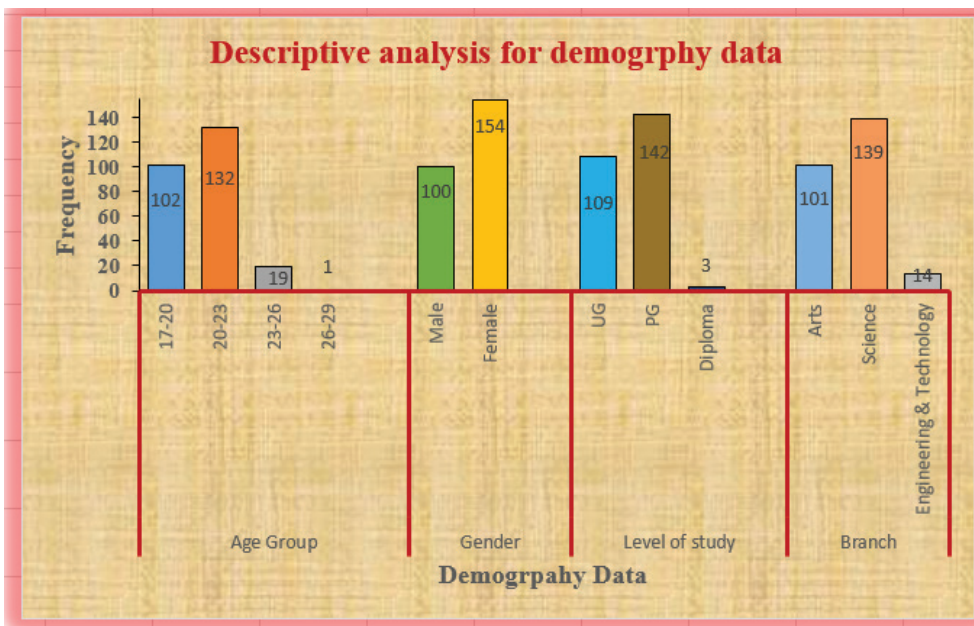


Figure 1. Descriptive analysis of survey respondents.

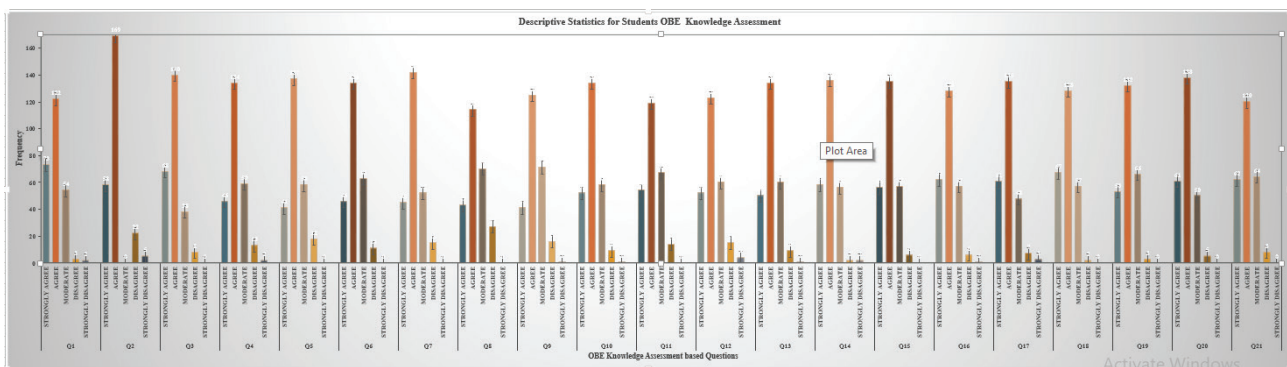


Figure 2. Descriptive analysis for Students awareness about OBE.

From the above results, it is observed that there is no statistical significant difference between male/female and academic degree branches. Furthermore, the completion of NPTEL courses significantly improved familiarity with Bloom’s taxonomy and the various learning areas, demonstrating the importance of additional instructional materials. In most cases, the findings of the chi-square test indicate that the significant variables in improving students’ understanding of educational frameworks are age and involvement, whereas gender and academic field seem to have minimal bearing on this knowledge.

The aim of the survey was to measure students’ perceptions of the OBE approach and finding its association between various socio-economic and educational outcome variables. Chi-square test was used to find the association between these variables. For students’ perceptions of having

been briefed on OBE during Orientation Week, significant relationships were found for age ($p = 0.005$) and NPTEL course completion ($p = 0.009$), implying that students’ perceptions differ based on age and NPTEL course completion status. However, there were no significant relationships found for students’ perceptions of having been briefed on OBE during Orientation Week and other characteristics, namely gender, level of study, and branch of study.

Regarding ‘Initial explanation of ‘Course Outcomes (COs),’ it was found that there were no significant associations with age, gender, level of study, branch of study, and NPTEL course completion. The results show that the perceptions of the students about understanding the explanation of CO have similar trends based on different characteristics of the students. The perceptions regarding accessing ‘OBE information’ were found to have no

Table 3. Chi-square test results showing significant factors influencing OBE knowledge

Characteristics		Frequency (Percentage)	Age Vs χ^2 (p-value)	Gender Vs χ^2 (p-value)	Level of study Vs χ^2 (p-value)	Branch Vs χ^2 (p-value)	NPTEL Course Completion Vs χ^2 (p-value)
1. I am aware that my college is launching an OBE strategy that focuses on students' performance.	Strongly Agree	73 (28.7%)	21.077	2.029	10.424	3.779	18.189 (0.001)
	Agree	122 (48%)	(0.049*)	(0.731)	(0.237)	(0.876)	
	Moderate	54 (21.3%)					
	Disagree	3 (1.2%)					
	Strongly Disagree	2 (0.8%)					
2. I am aware of the educational program objectives (PEO's/PSO's) for my college	Strongly Agree	58 (22.8%)	17.815	11.628	16.417	13.165	5.643 (0.130)
	Agree	169 (66.5%)	(0.037*)	(0.009*)	(0.012*)	(0.040*)	
	Moderate	0 (0%)					
	Disagree	22 (8.7%)					
	Strongly Disagree	5 (2%)					
3. I am aware of the Program Outcomes (POs) of my college.	Strongly Agree	68 (26.8%)	11.441	3.128	4.565	5.408	17.262 (0.001*)
	Agree	140 (55.1%)	(0.247)	(0.372)	(0.601)	(0.493)	
	Moderate	38 (15%)					
	Disagree	8 (3.1%)					
	Strongly Disagree	0 (0%)					
4. I am familiar with the methodologies used to compute PEO's/PSO's.	Strongly Agree	46 (18.1%)	25.696	5.571	8.162	11.823	10.655 (0.031)
	Agree	134 (52.8%)	(0.012*)	(0.234)	(0.418)	(0.159)	
	Moderate	59 (23.2%)					
	Disagree	13 (5.1%)					
	Strongly Disagree	2 (0.8%)					
5. I am familiar with the methodologies used to calculate POs.	Strongly Agree	41 (16.1%)	12.858	1.894	6.349	2.957	5.563 (0.135)
	Agree	137 (53.9%)	(0.169)	(0.595)	(0.385)	(0.814)	
	Moderate	58 (22.8%)					
	Disagree	18 (7.1%)					
	Strongly Disagree	0 (0%)					
6. I am familiar with the procedures for measuring Course Outcomes (COs).	Strongly Agree	46 (18.1%)	15.104	0.860	5.272	2.257	12.181 (0.007*)
	Agree	134 (52.8%)	(0.088)	(0.835)	(0.509)	(0.895)	
	Moderate	63 (24.8%)					
	Disagree	11 (4.3%)					
	Strongly Disagree	0 (0%)					
7. I was aware of the learning domains (cognitive, emotive, and psychomotor) that were assigned to each CO.	Strongly Agree	45 (17.7%)	20.542	0.727	6.686	7.167	8.701 (0.034*)
	Agree	142 (55.9%)	(0.015*)	(0.867)	(0.351)	(0.306)	
	Moderate	52 (20.5%)					
	Disagree	15 (5.9%)					
	Strongly Disagree	0 (0%)					
8. I am familiar with Bloom's taxonomy.	Strongly Agree	43 (16.9%)	9.823	3.135	10.625	2.579	10.956 (0.012*)
	Agree	114 (44.9%)	(0.365)	(0.371)	(0.101)	(0.860)	
	Moderate	70 (27.6%)					
	Disagree	27 (10.6%)					
	Strongly Disagree	0 (0%)					
9. During Orientation Week, I was briefed on the OBE method.	Strongly Agree	41 (16.1%)	28.348	1.160	7.546	11.961	13.602 (0.009*)
	Agree	125(49.2%)	(0.005*)	(0.885)	(0.479)	(0.153)	
	Moderate	71 (28%)					
	Disagree	16 (6.3%)					
	Strongly Disagree	1 (0.4%)					

Table 3. Chi-square test results showing significant factors influencing OBE knowledge (continued)

Characteristics		Frequency (Percentage)	Age Vs χ^2 (p-value)	Gender Vs χ^2 (p-value)	Level of study Vs χ^2 (p-value)	Branch Vs χ^2 (p-value)	NPTEL Course Completion Vs χ^2 (p-value)
10. The most of my course materials explained the COs of the courses initially in the semester.	Strongly Agree	52 (20.5%)	15.180 (0.232)	5.153 (0.272)	8.389 (0.396)	5.985 (0.649)	7.626 (0.106)
	Agree	134(52.8%)					
	Moderate	58 (22.8%)					
	Disagree	9 (3.5%)					
	Strongly Disagree	1 (0.4%)					
11. Everyone at my college has access to information about OBE.	Strongly Agree	54 (21.3%)	14.343 (0.111)	3.302 (0.347)	8.615 (0.196)	3.094 (0.797)	1.317 (0.725)
	Agree	119(46.9%)					
	Moderate	67 (26.4%)					
	Disagree	14 (5.5%)					
	Strongly Disagree	0 (0%)					
12. I feel that lecturer put more effort for teaching with OBE.	Strongly Agree	52 (20.5%)	11.825 (0.460)	2.000 (0.736)	9.420 (0.308)	6.309 (0.613)	12.725 (0.013)
	Agree	123(48.4%)					
	Moderate	60 (23.6%)					
	Disagree	15 (5.9%)					
	Strongly Disagree	4 (1.6%)					
13. I feel that lecturers work hard to ensure all students attain the learning outcome of their courses.	Strongly Agree	50 (19.7%)	12.151 (0.434)	7.364 (0.118)	12.443 (0.133)	19.772 (0.011*)	6.791 (0.147)
	Agree	134(52.8%)					
	Moderate	60 (23.6%)					
	Disagree	9 (3.5%)					
	Strongly Disagree	1 (0.4%)					
14. I feel that understanding the COs will help me to do better in my assessments.	Strongly Agree	58 (22.8%)	20.806 (0.053)	13.373 (0.010*)	8.433 (0.392)	12.434 (0.133)	10.449 (0.034*)
	Agree	136(53.5%)					
	Moderate	56 (22%)					
	Disagree	2 (0.8%)					
	Strongly Disagree	2 (0.8%)					
15. I am familiar of the evaluation standards used by my lecturers to grade students within classroom.	Strongly Agree	56 (22%)	17.004 (0.149)	7.027 (0.071)	8.163 (0.226)	16.841 (0.010)	7.518 (0.057)
	Agree	135(53.1%)					
	Moderate	57 (22.4%)					
	Disagree	6 (2.4%)					
	Strongly Disagree	0 (0%)					
16. I am completely aware of the association between assessments (quizzes, tests, assignments, practical tests, final exams, and so on) and the attainment of learning objectives.	Strongly Agree	62 (24.4%)	17.569 (0.041)	4.322 (0.364)	26.440 (0.001*)	13.465 (0.097)	6.524 (0.163)
	Agree	128(50.4%)					
	Moderate	57 (22.4%)					
	Disagree	6 (2.4%)					
	Strongly Disagree	1 (0.4%)					
17. The most of my lecturers encourage me to solve problems independently and to manage my independent learning.	Strongly Agree	61 (24%)	19.380 (0.080)	6.664 (0.155)	5.061 (0.751)	15.891 (0.044*)	4.933 (0.294)
	Agree	135 (53.1%)					
	Moderate	48 (18.9%)					
	Disagree	7 (2.8%)					
	Strongly Disagree	3 (1.2%)					
18. During class, I will get the opportunity to exhibit my communication abilities.	Strongly Agree	67 (26.4%)	15.940 (0.068)	3.868 (0.276)	1.475 (0.961)	1.516 (0.958)	1.363 (0.714)
	Agree	128 (50.4%)					
	Moderate	57 (22.4%)					
	Disagree	2 (0.8%)					
	Strongly Disagree	0 (0%)					

Table 3. Chi-square test results showing significant factors influencing OBE knowledge (continued)

Characteristics		Frequency (Percentage)	Age Vs χ^2 (p-value)	Gender Vs χ^2 (p-value)	Level of study Vs χ^2 (p-value)	Branch Vs χ^2 (p-value)	NPTEL Course Completion Vs χ^2 (p-value)
19. In class, students analyze, discuss, and reflect under our own opinion and perception.	Strongly Agree	53 (20.9%)	21.519 (0.011*)	6.948 (0.074)	37.361 (0.000*)	7.349 (0.290)	2.637 (0.421)
	Agree	132 (52%)					
	Moderate	66 (26%)					
	Disagree	3 (1.2%)					
	Strongly Disagree	0 (0%)					
20. My critical thinking abilities are improved by my professors' instructional techniques.	Strongly Agree	61 (24%)	16.735 (0.053*)	4.736 (0.192)	5.841 (0.441)	14.194 (0.028*)	0.706 (0.872)
	Agree	138 (54.3%)					
	Moderate	50 (19.7%)					
	Disagree	5 (2%)					
21. In class teaching and learning activities, I am exposed to case studies or real-life industry experience.	Strongly Agree	62 (24.4%)	17.417 (0.043*)	2.979 (0.395)	9.710 (0.137)	10.419 (0.108)v	3.481 (0.323)
	Agree	120 (47.2%)					
	Moderate	64 (25.2%)					
	Disagree	8 (3.1%)					
	Strongly Disagree	0 (0%)					

significant differences based on age, gender, level of study, branch of study, and completion of the course from NPTEL. This shows that the perceptions of the students regarding accessing 'OBE information' have similar trends based on different characteristics of the students. Regarding 'lecturer's effort in teaching with OBE,' it was found that there is a significant association with NPTEL course completion ($p = 0.013$), indicating that students who completed NPTEL courses perceive more effort from the lecturer in teaching 'OBE.' However, there were no significant differences based on age, gender, level of study, and branch of study.

The perception of students on lecturers' hard work in ensuring that all students achieve learning outcomes varied significantly by branch of study ($p = 0.011$) but not by age, gender, level of study, and completion of NPTEL courses. This implies that different branches of study perceive lecturers' hard work differently. Understanding COs and its performance in assessments was significantly associated with age ($p = 0.053$), gender ($p = 0.010$), and completion of NPTEL courses ($p = 0.034$). This implies that age, gender, and completing additional courses could affect students' perception of understanding COs and its performance in assessments. Finally, understanding evaluation standards was significantly associated with branch of study ($p = 0.010$) but not with age, gender, level of study, and completion of NPTEL courses. This implies that students' understanding of evaluation standards is affected by the branch of study.

Chi square test were used to find the association between the variables. Form the results, it is observed that there is strong association between the variables. More specifically,

the subject is closely linked with students' perceptions of encouragement for independent problem-solving, the development and acquisition of critical thinking skills, and the use of case studies or real-world industry experiences. Age significantly acts as a factor that affects classroom discussion and contemplation opportunities, as well as gains in critical thinking and real-world learning experiences. In contrast, variables such as gender and NPTEL course completion implies that little correlation with these perceptions, suggesting minimal influence on the student learning environment. As a whole, the data indicate that a student's age and field of study have a greater impact on their educational experience than their gender or involvement in supplementary courses, underlining the role of these demographic variables in shaping the learning environment.

Finally, the survey findings revealed that 65.86% of the students were knowledgeable about Outcome-Based Education (OBE). The chi-square test was used for additional analysis, which revealed that age and completion of NPTEL courses had a significant impact on students' knowledge of OBE. Older students showed a higher level of understanding about OBE. In addition, no significance was observed in the awareness of the students about gender and branches of academics. This indicated that these factors did not play a major role in the awareness of the students about OBE.

The findings of the present study indicate that a massive portion of students have a strong understanding of the basic principles of Outcome-Based Education (OBE), i.e., focus on learning outcomes, competency-based evaluation, and

student-centeredness. These findings are similar to those of other research works (e.g., Borsoto et al., [1]; Caguimbal et al., [8]), where it was highlighted that students' understanding of learning outcomes is greatly influenced by the transparent approach of Outcome-Based Education. However, what is new and different about the present research is its focus on exploring students' awareness of Outcome-Based Education based on other demographic characteristics, i.e., age and participation in supplementary courses (e.g., NPTEL). Although the majority of the existing literature (e.g., Harden [4]; Davis et al. [16]) has focused on the impact of OBE on the learning outcomes, this study is one of the first to consider the role of these demographic variables in the way that they impact the students' understanding of OBE. The data indicates that the older students and those involved in more courses have a better understanding of OBE, reinforcing the importance of these factors for the development of a more thorough understanding.

As far as the methods used in carrying out the OBE are concerned, the research reveals that these have had a positive effect on the learning processes and attitudes of students. Tan [6] and Rhaffor [15] has identified the benefits of these methods in ensuring greater student engagement. Some of the benefits of OBE, as identified in this research, include clearer learning objectives, greater alignment of curriculum and learning outcomes, and greater potential for self-directed learning, which are in conformity with the overall body of literature on the benefits of OBE. Some of the challenges affecting the implementation of OBE, as identified in this research, include unclear learning objectives, poor assessment methods, and faculty members. This is similar to the challenges identified in the studies done by Cook et al. [10] and Rhaffor et al. [15], where these challenges were also identified as impediments to the adoption of OBE. The challenges identified indicate the need to ensure that there are effective strategies to overcome these impediments for the effectiveness of OBE. Resistance from the faculty members is also a major challenge, which indicates the need to ensure that the faculty members are adequately prepared.

In response to these challenges, the students made various suggestions regarding the implementation of OBE. Among the suggestions made were better communication of the set learning goals, provision of more resources for the development of the faculty members, and more opportunities for the students to participate in the decision-making processes concerning the implementation of OBE. The suggestions made by the students were in compliance with the findings made by Shaheen [13] and Guico et al. [17] which highlighted the need for a supportive and participating environment for the successful implementation of OBE. The study also found that the students who undertook supplementary courses such as NPTEL had a better understanding of the principles of OBE. This indicates that the integration of extra-curricular learning activities can be an essential strategy in promoting students' awareness and

understanding of OBE. From the findings, it also supports the suggestions made by Vennila et al. [14], which indicate that the integration of additional learning activities can play a significant role in promoting students' understanding of education frameworks like OBE.

CONCLUSION

This study aims to assess graduating students' awareness of Outcome-Based Education (OBE), and it was found that students have a good understanding of its principles, such as developing specific skills and competencies. Furthermore, it was found that students' age and participation in additional courses such as NPTEL have significant effects on students' awareness and attitudes towards Outcome-based education. Most students showed awareness and agreed on the significance of Outcome-based education, and it was found that students' educational background could affect students' awareness of Outcome-based education. This study adds new knowledge regarding students' awareness of Outcome-based education and its relationship with students' age and participation in additional courses, as it was found that these factors were not considered in previous literature. Future studies could be conducted to find how these factors can be utilized to better Outcome-based education practices, and the educational institutions could utilize the information to design effective strategies to improve student knowledge and engagement with Outcome-based education, leading to its successful integration into the educational system.

The simulations are comprehensive and offer important insights, but the publication does not cover the study's flaws or potential future research areas. If the publication addressed the possible drawbacks in the current study, such as limitations in simulation parameters, scope, or applicability, and suggested specific areas for future research, the authors think it might give a more thorough data analysis. By helping future research concentrate on unresolved issues and advance the field, this method will also increase the reliability of the study.

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