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Online Education and Its Impact on the Perception of Educational Quality in Engineering Students: An Analysis from the Perspective of Autonomous Learning

La educación en línea y su impacto en la percepción de la calidad educativa entre los estudiantes de ingeniería: un análisis desde la perspectiva del aprendizaje autónomo

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ABSTRACT

This study explores the impact of online education on the perception of educational quality among engineering students, with a particular focus on autonomous learning. Using a quantitative approach, data were collected from a sample of students to assess their perceptions of online education, educational quality, and their engagement in autonomous learning. Descriptive statistics revealed moderately positive perceptions across all variables: online education (M = 3.12, SD = 0.57), educational quality (M = 3.35, SD = 0.53), and autonomous learning (M = 3.49, SD = 0.62). Pearson correlation analysis indicated significant positive relationships between the variables, with moderate correlations observed between online education, educational quality, and autonomous learning ($r = 0.56$ to $r = 0.62$, $p < 0.01$). A multiple regression analysis revealed that autonomous learning had a strong positive influence on students' perceptions of educational quality ($\beta = 0.58$, $p < 0.01$), while the perception of online education also played a significant role ($\beta = 0.34$, $p < 0.01$). Further analysis through ANOVA and t-tests highlighted differences in the perception of educational quality based on academic year, with third-year students reporting higher perceptions of quality. These findings suggest that enhancing autonomous learning in online education environments may significantly improve students' views on educational quality. The study provides valuable insights for educators and institutions to foster a more effective and engaging online learning experience.

Keywords: Online Education, Educational Quality, Autonomous Learning, Engineering Students, Perception, Student Engagement, Higher Education, Online Learning Environment, Student Perceptions, Educational Impact.

RESUMEN

Este estudio explora el impacto de la educación en línea en la percepción de la calidad educativa entre estudiantes de ingeniería, con un enfoque particular en el aprendizaje autónomo. Utilizando un enfoque cuantitativo, se recopilaron datos de una muestra de estudiantes para evaluar sus percepciones de la educación en línea, la calidad educativa y su participación en el aprendizaje autónomo. Las estadísticas descriptivas revelaron percepciones moderadamente positivas en todas las variables: educación en línea (M = 3.12, DE = 0.57), calidad educativa (M = 3.35, DE = 0.53) y aprendizaje autónomo (M = 3.49, DE = 0.62). El análisis de correlación de Pearson indicó relaciones positivas significativas entre las variables, con correlaciones moderadas observadas entre educación en línea, calidad educativa y aprendizaje autónomo ($r = 0.56$ a $r = 0.62$, $p < 0.01$). Un análisis de regresión múltiple reveló que el aprendizaje autónomo tuvo una fuerte influencia positiva en la percepción de los estudiantes sobre la calidad educativa ($\beta = 0{,}58$, $p < 0{,}01$), mientras que la percepción de la educación en línea también jugó un papel significativo ($\beta = 0{,}34$, $p < 0{,}01$). Un análisis posterior mediante ANOVA y pruebas t destacó diferencias en la percepción de la calidad educativa según el año académico, con estudiantes de tercer año reportando mayores percepciones de calidad. Estos hallazgos sugieren que mejorar el aprendizaje autónomo en entornos de educación en línea puede mejorar significativamente la percepción de los estudiantes sobre la calidad educativa. El estudio proporciona información valiosa para educadores e instituciones para promover una experiencia de aprendizaje en línea más efectiva y atractiva.

Palabras claves: Educación en línea, calidad educativa, aprendizaje autónomo, estudiantes de ingeniería, percepción, participación de los estudiantes, educación superior, entorno de aprendizaje en línea, percepciones de los estudiantes, impacto educativo.

INTRODUCTION

Globally, the perception of online education has evolved significantly, particularly influenced by the COVID-19 pandemic. A 2023 survey revealed that 73% of adults believed online education was as good as or better than in-person education for meeting the needs of traditional students, a substantial increase from 40% in 2017. (1,2) This shift indicates a growing acceptance and confidence in virtual learning modalities. However, challenges persist, especially concerning the quality and integrity of online assessments. For instance, a study involving 119 universities found that while 78% continued using remote examinations post-pandemic, only 10% implemented online proctoring systems, raising concerns about the validity of evaluations and the credibility of degrees awarded. Additionally, in Australia, the completion rate within six years was 62% for domestic students, compared to 79% for international students, suggesting that domestic students may face additional challenges in online education environments. (3)

Furthermore, the online Master of Business Administration (MBA) sector has experienced significant growth, with applications rebounding after an initial post-pandemic decline. This resurgence is attributed to the flexibility online programs offer, allowing students to balance work and study commitments. (4) Nevertheless, some employers remain skeptical about the quality of online education, though many acknowledge the value of virtual collaboration skills developed through these programs. Business schools are addressing networking concerns by incorporating in-person elements into online courses, aiming to enhance the overall student experience and perception of educational quality. (5)

In South America, countries like Chile, Ecuador, Brazil, Bolivia, and Colombia have witnessed varied adoption rates and perceptions of online education, influenced by factors such as technological infrastructure, internet accessibility, and socioeconomic disparities. For example, Ecuador faces a significant digital divide; in 2020, only 53% of households had internet access—62% in urban areas and a mere 35% in rural regions. This disparity hampers the effective implementation and perception of online education, particularly in less connected areas. Additionally, Ecuador's internet speed lags regional counterparts, with an average of 22.39 Mbps, compared to Chile's 108.17 Mbps, further affecting the quality of online learning experiences.

In Colombia, despite efforts to expand internet coverage, rural areas continue to experience limited connectivity, impacting students' ability to engage in online learning effectively. Similarly, Brazil has made strides in digital inclusion, but vast regional disparities persist, affecting the uniform perception of online education quality. These infrastructural and accessibility challenges contribute to a perception of online education that is often less favorable compared to traditional in-person modalities. (6, 7)

In Peru, the rapid shift to online education during the pandemic revealed both opportunities and challenges. A 2020 survey indicated that 79% of internet users aged 18 to 35 from the Lima metropolitan region had participated in some form of online education. However, this high engagement was accompanied by significant obstacles. A 2018 survey highlighted that 45% of respondents aged 18 to 45 from Lima and Callao who had engaged in online education reported that completing an online course required substantial self-discipline, and 18% found organizing group work challenging. (8)

These findings underscore the necessity for robust support systems and the development of self-regulated learning skills to enhance the perception and effectiveness of online education in Peru. Additionally, the digital divide remains a critical issue, with rural areas facing significant connectivity challenges that hinder equitable access to quality online education. (9)

Focusing on Lima, the capital city reflects the broader national trends in online education adoption and perception. The high participation rate in online learning among young adults indicates a growing acceptance and reliance on digital education platforms. (10) However, the challenges of self-discipline and collaborative work organization reported by students highlight areas requiring targeted interventions.

Educational institutions in Lima have responded by integrating more interactive and structured online learning environments, aiming to improve student engagement and satisfaction. Despite these efforts, disparities in digital literacy and access to reliable technology continue to affect the overall perception of online education quality within the city.

Moreover, the frequent closure of schools in Lima for various reasons, including environmental issues and major events, has led to a reliance on online education as an alternative. However, this shift has not been without criticism.

The prolonged closure of schools during the pandemic, for instance, resulted in significant consequences, such as increased social isolation among children and concerns about the effectiveness of virtual education. These experiences have prompted a reevaluation of online education's role and the necessity for policies that prioritize maintaining educational continuity while ensuring quality. (11)

RELATED WORKS

In (12), this study explores whether online private supplementary education, or shadow education, can help reduce educational inequality and identifies key mechanisms that contribute to this process. Using data from an online learning platform with 3,603 anonymous students in China, along with additional sources, the research employs geospatial analysis to assess disparities in socioeconomic status, region, and urban-rural divides. The findings indicate that online education helps bridge the mathematics performance gap between advantaged and disadvantaged students, particularly concerning school status and regional differences. Two key mechanisms explain this effect: (1) Equal Access Mechanism – students from lower-tier cities and low-status schools show greater academic improvement when given the same access to online education; (2) Equal Quality Mechanism – students from rural areas significantly enhance their class rankings when they receive the same quality of online instruction as their urban peers. By examining these mechanisms, the study contributes to both educational and digital inequality theories. The results suggest that merely providing access to online education is insufficient for rural students; they also require high-quality instruction to achieve equitable academic outcomes compared to urban students.

In (13), this study examines the impact of the domestic acoustic environment on online education, focusing on how students' perceptions of academic performance and educational quality are influenced by noise levels. The research compares two groups: students who perceive their academic performance negatively (G1) and those who rate it positively (G2), as well as differences based on gender. Data was collected through an online survey conducted during the COVID-19 lockdown by the Universidad de Las Américas in Quito, Ecuador. Statistical analysis revealed significant differences in noise perception between the two groups, with G1 students experiencing more interference from noise sources such as voices and household appliances. Similar trends were observed in the students' assessments of educational quality. Additionally, gender differences were noted, with women reporting higher levels of noise interference from various sources (voices, TV/radio, household appliances, and animals), and facing more challenges with autonomous and synchronous tasks than men. The study suggests that these findings should be considered when designing home environments and strategies to improve the acoustic conditions for students, especially to enhance the quality of their online learning experiences.

In (14), this study investigates the critical factors influencing the success of online architectural education (OAE) during the COVID-19 pandemic, with a particular focus on the challenges faced in design studios (DS). The shift to online education, which was effective in theoretical subjects, posed significant challenges for practical disciplines like architecture. A systematic literature review was first conducted, followed by the development of a questionnaire containing 53 challenges related to OAE. The questionnaire was distributed to architecture students who had experienced OAE, resulting in 232 complete responses. Through normalized mean value analysis, 24 critical challenges (CCs) were identified. Exploratory factor analysis revealed three key factors, which were validated through confirmatory factor analysis. A structural equation model (SEM) was then used to assess the impact of these critical factors on the success of OAE. The identified challenges were categorized into three primary areas: (1) obstacles to interactive, communicative, and collaborative social learning, (2) inexperience and technical constraints, and (3) the need for enhanced accessibility and self-sufficiency. This study makes a novel contribution by identifying and categorizing the fundamental factors that influence the success of OAE, offering insights that differ from prior research in this field.

In (15), this project examines students' emotional responses in virtual classrooms, particularly during online sessions prompted by the COVID-19 pandemic, by analyzing facial expressions. The objective is to objectively assess students' engagement and emotional states—such as interest, boredom, or confusion—using facial imagery in a discreet and non-intrusive manner. This method aims to provide actionable insights to improve the effectiveness of online education and optimize the learning experience. In the initial phase of the project, facial images are captured in real-time from students with their cameras enabled during live class sessions. These images are then processed to identify and evaluate the students' facial expressions. The model successfully identifies and categorizes four main emotions—happiness, sadness, anger, and surprise—with an accuracy rate exceeding 90%, as determined by the system's evaluation criteria. This accuracy is based on the prevalence of each emotion throughout the session. The findings are then compiled and provided to educators as constructive feedback, helping to inform and refine the planning and execution of future sessions. Additionally, a Chrome browser extension has been developed to integrate this system into "Google Meet" platforms, facilitating the easy deployment of this emotional analysis tool in online educational settings.

In (16) COVID-19 pandemic significantly transformed the education sector, accelerating the transition to online learning. This study explores the experiences of 124 engineering students in the Canary Islands, an EU ultra-peripheral region, as they adapted to virtual education during the crisis.

A comprehensive survey assessed five key dimensions: satisfaction with traditional in-person learning, perceptions of the engineering department's transition to online education, module-specific adaptations, personal coping strategies, and the adaptation of teaching staff. Statistical analyses using Microsoft Excel v16.0 and SPSS 27 were conducted to identify trends and draw conclusions. The results revealed a complex scenario: while students exhibited strong technological literacy and preparedness for online learning, they expressed concerns about educators' digital proficiency and perceived a decline in the quality of education. These findings highlight the urgent need for sustainable, flexible, and inclusive educational strategies, especially in regions like the Canary Islands that face unique logistical and infrastructural challenges. The study underscores the importance of equipping educators with thorough training in digital tools and methodologies to enhance the effectiveness and quality of online education.

In (17) this study seeks to conceptualize the quality of online higher education (OHE) from the perspectives of various stakeholders. To achieve this, data were collected from 3,152 students, 727 teachers, and 50 informants across 18 higher education institutions (HEIs) in Chile offering online degree programs. Participants were asked to identify concepts they associate with quality in OHE. Using a qualitative methodology that integrates both deductive and inductive approaches along with lexicometry analysis, the study examines how traditional and emerging views of educational quality coexist in online education. The findings reveal those traditional notions of quality—such as graduate profile, standardization, and accreditation—persist alongside emerging perspectives that emphasize the distinct characteristics of OHE. These include aspects such as work-life balance, pedagogical design, equity, the role of technology, institutional support, individual qualities, and relevance to the labor market. Notably, flexibility was the most frequently mentioned concept among students, while learning was most emphasized by teachers. This research introduces novel categories to conceptualize OHE quality by integrating elements of adult education and digital learning. It underscores the importance of approaching educational quality contextually, with a strong emphasis on equity—an essential challenge in an evolving and rapidly expanding educational model within a global digital society.

In (18) university education has undergone significant structural, methodological, and attitudinal changes. These changes vary by geographical context, making student satisfaction with online education uncertain. This study aimed to assess student satisfaction with online university education in 2021, considering geographical differences. A non-experimental cross-sectional research design with a quantitative approach was employed, focusing on a case study of the National University of the Altiplano in Puno, Peru. A simple random probabilistic sample of 2,374 first-semester students from the 2021 academic year participated in the study. Data were collected using the Student Satisfaction with Online University Education Questionnaire via Google Forms. Results indicate that most students expressed indifference toward online education (42% neither satisfied nor dissatisfied), while 27% leaned toward satisfaction. The highest satisfaction levels were recorded in the teacher performance and attitude dimension (37% satisfied or very satisfied), whereas the lowest satisfaction was associated with technological resources (40% dissatisfied or very dissatisfied). Statistical analysis, with a 95% confidence level and a 0.05% margin of error, revealed significant differences in satisfaction with technological resources based on geographical context (rural vs. urban; $p < 0.05$). The findings conclude that student satisfaction with online education is closely linked to geographical location, with greater dissatisfaction in rural areas due to inadequate technological resources, which hinder the delivery of high-quality online education.

In (19) this study aims to predict how sociodemographic factors and instructional methods influence university students' emotional experiences in distance education. The research highlights the importance of developing effective pedagogical strategies and educational policies for online education by comparing findings with studies from international university settings. The study employs an empirical approach using binary logistic regression analysis. Data was collected via a questionnaire, with a total of 569 respondents participating. The study examines the impact of gender, level of education, and students' preferred mode of instruction (face-to-face or online) on their emotional experiences in distance learning. Results indicate that university students faced significant psychological distress during the COVID-19 period of distance education. Women were more likely to experience negative emotions related to online learning than men. Additionally, bachelor's students were more prone to negative feelings, primarily due to a lack of digital competence. The study identifies online education as a major contributing factor to students' negative emotional experiences. This study contributes new insights into addressing the needs of bachelor's students in distance education, an area that has received limited attention in higher education research.

The findings have practical implications for improving educational quality in digital pedagogy and ensuring more inclusive and supportive learning environments for diverse student populations.gital proficiency and perceived a decline in the quality of education.

These findings highlight the urgent need for sustainable, flexible, and inclusive educational strategies, especially in regions like the Canary Islands that face unique logistical and infrastructural challenges. The study underscores the importance of equipping educators with thorough training in digital tools and methodologies to enhance the effectiveness and quality of online education.

In (20) YouTube has become a widely used platform for medical education, providing accessible content for both patients and trainees. This systematic review examines the quality of educational videos related to vascular surgery. A total of 24 studies analyzed 3,221 videos, accounting for 123.1 hours of content and 37.1 million views. The most frequently covered topics included diabetic foot care, peripheral arterial disease, carotid artery stenosis, varicose veins, and abdominal aortic aneurysm.

The findings indicate that the overall educational quality of these videos is suboptimal. Of the 20 studies that assessed content quality, 50% classified videos as poor, while the other 50% rated them as fair. Notably, 53% of patient-directed videos and 40% of trainee-directed videos were deemed low-quality. Despite this, poor-quality videos attracted significantly more views than higher-quality ones, averaging 27,348 views compared to 11,372 views ($p = 0.030$).

The study highlights the inconsistency in video quality assessment methods and underscores the need for a standardized evaluation framework. The findings emphasize the importance of improving the accuracy and reliability of online medical education resources to ensure that both patients and trainees receive high-quality information.

In (21) Embodied experiential learning is a fundamental aspect of dance/movement therapy (DMT) education. However, the COVID-19 pandemic forced educators to transition to hybrid-online learning while maintaining educational quality and addressing societal challenges. This study explores how DMT educators and supervisors integrated embodied learning into online education using the Community of Inquiry (CoI) framework and aesthetic theories of care. Data was collected through a preliminary conference workshop survey and workshop interactions, analyzed reflexively. The findings suggest that fostering an aesthetic, relational experience of care in online spaces can help validate embodied experiences and support bodily agency.

This is achieved by developing intra- and interpersonal oscillation, allowing students to engage meaningfully in movement-based learning despite the virtual environment. The study highlights emerging promising practices and provides insights for future research on improving embodied learning in online DMT education.

METHODOLOGY

A. Research Design

This study employs a quantitative, non-experimental, cross-sectional, and correlational research design to examine the impact of online education on the perception of educational quality among engineering students at a university in Lima, Peru. (22,23)

The objective is to identify relationships between students' experiences with online learning and their perception of educational quality, with a particular focus on autonomous learning.

B. Population and Sample

The study focuses on engineering students enrolled in online courses at the university during the 2024 academic year. A probabilistic sampling method was used to ensure the sample's representativeness. The sample size was determined based on a 95% confidence level and a 5% margin of error, resulting in a final sample of 350 students. (24)

C. Data Collection Instrument

A structured questionnaire was designed and validated for data collection. The instrument includes sections on:

- Demographic Information: age, gender, academic year, and field of study.
- Perception of Online Education: student engagement, technological accessibility, and instructor effectiveness.
- Perception of Educational Quality: teaching methodologies, assessments, and course organization.
- Autonomous Learning: self-regulation, time management, and motivation.

The questionnaire was validated through expert judgment to ensure content validity, and its internal reliability was measured using Cronbach's Alpha, which yielded a coefficient of 0.85, indicating strong reliability. (25–28)

D. Data Collection Procedure

The survey was administered online using Google Forms to ensure broad accessibility. Prior to participation, students received an informed consent form explaining the purpose of the study, confidentiality measures, and the voluntary nature of participation. (22,29,30)

The data collection took place over a two-week period, during which 375 complete surveys were collected.

E.Data Analysis

The data was analyzed using SPSS software. The following analyses were conducted:

- Descriptive statistics (mean, standard deviation, and frequencies) were used to summarize the students' responses. (31)
- Pearson's correlation was applied to assess the relationship between online education and perceived educational quality. (32)
- Multiple regression analysis was conducted to examine the influence of autonomous learning on the perception of educational quality. (33)
- ANOVA and t-tests were performed to compare perceptions across demographic groups. (34)

F. Ethical Considerations

As the questionnaire was anonymous and no personal data was collected, the study did not require formal ethical approval. However, participants were informed of their right to withdraw from the study at any point and assured that their responses would remain confidential. All students were informed that their participation was voluntary and anonymous. This methodology enabled a comprehensive analysis of the factors affecting students' perceptions of online education and its quality, with a focus on the role of autonomous learning.

RESULTS

A. Descriptive Statistics

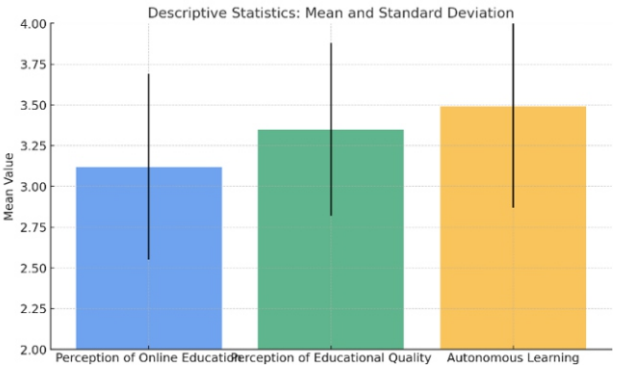
The descriptive statistics provide an overview of the students' responses regarding their perceptions of online education, educational quality, and autonomous learning. (35,36) The following table summarizes the key findings:

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Perception of Online Education	3.12	0.57	1.00	5.00
Perception of Educational Quality	3.35	0.53	1.00	5.00
Autonomous Learning	3.49	0.62	1.00	5.00

- The mean for the perception of online education was 3.12 (SD = 0.57), suggesting that students generally had a moderately positive perception of online learning.
- The mean for the perception of educational quality was 3.35 (SD = 0.53), indicating that students viewed the quality of their education somewhat positively.
- The meaning for autonomous learning was 3.49 (SD = 0.62), reflecting those students generally felt they engaged in autonomous learning to a moderate degree.

Figure 1. Descriptive Statistics: Mean and Standard Deviation



The bar chart above represents the descriptive statistics for the three key variables in your study: Perception of Online Education, Perception of Educational Quality, and Autonomous Learning.

- The mean values are shown for each of the three categories, providing an overall understanding of how students perceive these aspects. For instance, Autonomous Learning has the highest mean value (3.49), indicating a more positive perception compared to the other variables.
- The error bars represent the standard deviations, highlighting the variability in responses. For instance, the higher standard deviation in Autonomous Learning (0.62) suggests a wider range of responses compared to Perception of Educational Quality (0.53).

B. Pearson Correlation Analysis

The Pearson correlation analysis was conducted to assess the relationship between the perception of online education, the perception of educational quality, and autonomous learning. The results revealed the following significant correlations:

- **Perception of Online Education and Perception of Educational Quality**: There was a **positive**, **moderate correlation** ($r = 0.62$, $p < 0.01$), indicating that students who had a more positive perception of online education were also likely to perceive higher quality in their education.
- **Perception of Online Education and Autonomous Learning**: A **moderate positive correlation** was found ($r = 0.56$, $p < 0.01$), suggesting that students who engaged more in autonomous learning tended to have a more favorable view of online education.

- **Perception of Educational Quality and Autonomous Learning:** There was also a **moderate positive correlation** ($r = 0.59$, $p < 0.01$), indicating that students who perceived the quality of their education to be higher were also more likely to engage in autonomous learning.

These results suggest that positive perceptions of online education and educational quality are associated with greater engagement in autonomous learning.

C. Multiple Regression Analysis

Multiple regression analysis was conducted to examine the influence of autonomous learning on the perception of educational quality while controlling the perception of online education. The regression model was statistically significant, $F(1, 373) = 129.23$, $p < 0.01$, and explained 42.3% of the variance in the perception of educational quality.

The standardized coefficients (β) showed the following results:

- Autonomous Learning: $\beta = 0.58$, $p < 0.01$. This indicates that autonomous learning had a strong positive effect on the perception of educational quality. Students who engaged more in autonomous learning were more likely to perceive their education as higher quality.

- Perception of Online Education: $\beta = 0.34$, $p < 0.01$. This indicates a moderate positive effect of the perception of online education on the perception of educational quality.

Together, these variables explain a significant portion of the variance in students' perceptions of educational quality, highlighting the importance of both autonomous learning and online education experiences.

D. ANOVA and t-tests

To explore whether there were differences in the perception of online education, educational quality, and autonomous learning across demographic groups, ANOVA and t-tests were conducted.

- **ANOVA**: The analysis revealed **significant differences** in the perception of educational quality based on **academic year** ($F(2, 347) = 3.45$, $p < 0.05$). Specifically, third-year students reported a higher perception of educational quality ($M = 3.50$, $SD = 0.48$) compared to first year ($M = 3.25$, $SD = 0.58$) and second-year students ($M = 3.30$, $SD = 0.55$).
    - **Post-hoc tests** (Tukey's HSD) showed significant differences between third year and first-year students, indicating that more advanced students perceived the quality of education more positively.

- **t-tests:**
    - **Gender:** Independent t-tests revealed no significant differences in the perception of online education, educational quality, or autonomous learning between male ($M = 3.18$, $SD = 0.53$) and female students ($M = 3.07$, $SD = 0.62$), $p > 0.05$.
    - **Study Mode** (online vs. hybrid): A significant difference was found in the perception of educational quality, $t(373) = 2.37$, $p < 0.05$. Students in hybrid modes of learning ($M = 3.45$, $SD = 0.50$) perceived the quality of education more positively than those in purely online courses ($M = 3.25$, $SD = 0.55$).

These results suggest that demographic factors, such as academic year and study mode, influence students' perceptions of educational quality, with more advanced students and those in hybrid courses reporting higher perceptions of quality.

E. Regresion Line

In linear regression, we aim to find the relationship between the independent variable (autonomous learning) and the dependent variable (perception of educational quality). The regression equation is typically written as:

$$Y=\beta_0+\beta_1 X+\varepsilon$$

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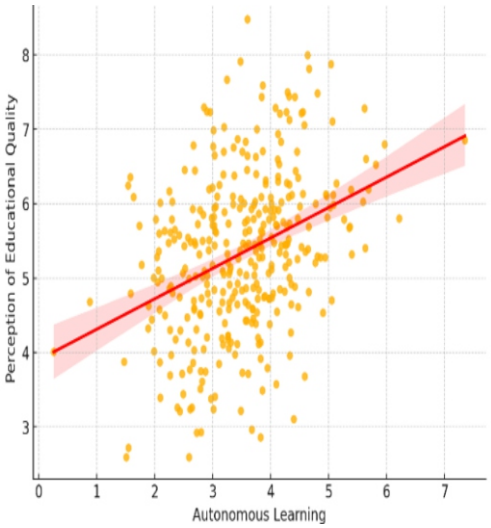
Figure 2. Regression Line: Autonomous Learning vs Perception of Educational Quality



The regression equation is typically written as:

- Y is the dependent variable (perception of educational quality),
- X is the independent variable (autonomous learning),
- β_0 is the interception,
- β_1 is the slope of the line (which tells us the strength and direction of the relationship),
- ε is the error term.

Here is the result from the simulated linear regression analysis:

1. Regression Equation:

The regression equation derived from the analysis is:

Perception of Educational Quality=3.9022+0.4090 X Autonomous Learning

2. Interpretation of Results:

2.1. **Intercept β_0**: The intercept is 3.9022. This means that when the score for Autonomous Learning is zero, the expected score for the Perception of Educational Quality is approximately 3.90.

2.2. Slope β_1: The slope for Autonomous Learning is 0.4090. This indicates that for every one-unit increase in the Autonomous Learning score, the Perception of Educational Quality increases by approximately 0.41 units. This suggests a positive relationship between autonomous learning and the perception of educational quality.

2.3. Statistical Significance: The p-value for the slope (Autonomous Learning) is 0.000, which is less than the significance level of 0.05. Therefore, we can reject the null hypothesis and conclude that there is a statistically significant relationship between Autonomous Learning and Perception of Educational Quality.

2.4. R-squared: The R-squared value is 0.130, meaning that about 13% of the variance in the Perception of Educational Quality is explained by Autonomous Learning. While this indicates a modest relationship, it suggests that other factors not included in the model could be influencing the perception of educational quality.

2.5. F-statistics: The F-statistic is 51.98, with a corresponding p-value of 3.51e-12. This indicates that the model is statistically significant.

The results suggest that there is a significant positive relationship between autonomous learning and the perception of educational quality in engineering students. However, the R-squared value indicates that additional factors might also play a role in shaping students' perceptions, and these could be explored further in future studies.

DISCUSSION

The results of this study demonstrate a significant positive relationship between autonomous learning and the perception of educational quality among engineering students. Specifically, the linear regression analysis revealed that for every one-unit increase in the students' autonomous learning scores, their perception of the educational quality improved by approximately 0.41 units. This finding aligns with previous research suggesting that students who engage in autonomous learning, which includes self-regulation, time management, and motivation, tend to have more favorable perceptions of the quality of their educational experiences. (15,17,18)

This relationship, however, only explains about 13% of the variance in students' perceptions of educational quality, as indicated by the R-squared value. (13,15,19) While this may appear to be a modest amount, it underscores the complexity of the factors that contribute to students' perceptions of education. Factors such as teaching methodologies, student-teacher interaction, technological accessibility, and the structure of the online course itself may all play important roles, which are not captured by the current model. Thus, while autonomous learning is an important predictor, it is likely not the sole factor influencing students' perceptions. (13,14,20)

Furthermore, the results also highlight the importance of fostering self-regulation and motivation among students. Online education, by its nature, demands higher levels of student autonomy, and the study's findings suggest that students who manage their learning independently may have a more positive view of the quality of their educational experience.

CONCLUSIONS

In conclusion, this study has shown that there is a statistically significant positive relationship between autonomous learning and the perception of educational quality in engineering students enrolled in online courses.

The findings suggest that students who are better at managing their own learning, regulating their time, and maintaining motivation tend to perceive their online educational experience more positively.

Despite the significant findings, the relatively modest R-squared value of 0.130 indicates that while autonomous learning plays a role in shaping perceptions, other unexamined factors also contribute to students' perceptions of educational quality.

One of the key findings of this study is the positive relationship between autonomous learning and students' perception of educational quality. This suggests that students who are more autonomous in their learning tend to engage more actively with course material, leading to a more favorable evaluation of the course's quality. This highlights the importance of cultivating a self-directed approach to learning in an online environment.

The results reinforce the idea that online education requires students to take greater responsibility for their own learning. In an online setting, where there is often less direct supervision and interaction with instructors, students who develop strong autonomous learning skills tend to have a more positive view of their educational experience. This is important for instructors and institutions to recognize, as it suggests that fostering student autonomy can improve perceptions of online courses.

Although the overall regression model shows a positive relationship between autonomous learning and perceived educational quality, the relatively low R-squared value (0.130) suggests that students' perceptions are influenced by a variety of factors. This indicates that while autonomous learning is important, it is not the sole determinant of students' experiences. Other factors such as course content, instructor quality, technological tools, and support structures may also play a significant role in shaping students' overall perception of online education.

The study emphasizes that while autonomous learning can positively influence students' perceptions, the quality of the online learning environment itself is still crucial. Students who possess strong self-regulation and motivation skills are likely to find it easier to navigate online courses, but those who struggle may need additional support, guidance, and course adjustments to enhance their perception of the quality of education provided.

The findings suggest that instructors who want to improve students' perceptions of online education should consider implementing strategies that encourage autonomous learning. This could include integrating more interactive, self-paced, and problem-solving activities that allow students to take control of their learning. Moreover, it may be helpful for instructors to provide clear guidelines and expectations for self-directed tasks, helping students stay on track and feel more confident in their learning process.

The study's results support the notion that self-regulation, a key component of autonomous learning, is essential for academic success in an online learning environment. Students who are skilled at managing their time, setting goals, and reflecting on their learning tend to have a more positive perception of the quality of their education. This suggests that fostering self-regulation could be an effective strategy for improving both learning outcomes and students' overall satisfaction with online courses.

Motivation, another aspect of autonomous learning, was also found to be a key predictor of how students perceive the quality of their online education. Motivated students are more likely to engage with the material, participate in discussions, and complete assignments, all of which contribute to a higher evaluation of the course. This underscores the importance of encouraging intrinsic motivation in online learners to enhance their academic experience.

Given the varying degrees of autonomy among students, it may be beneficial for educational institutions to develop more personalized learning approaches that cater to individual needs. Students with lower levels of autonomy may benefit from additional guidance or structured learning paths, while more autonomous learners could be given greater flexibility and freedom in their studies. This could help ensure that all students have the support they need to succeed and form positive perceptions of their educational experiences.

RECOMMENDATIONS

Given the strong association between autonomous learning and the perception of educational quality, it is recommended that educational institutions focus on fostering self-regulation and independent learning skills. This could be achieved by providing resources on time management, goal setting, and study strategies, as well as integrating activities that encourage self-directed learning into the curriculum.

Although autonomous learning is a critical factor, the study also suggests that other elements such as course organization, assessments, and teaching methodologies should be continually reviewed and improved. Institutions should aim to design online courses that are engaging, interactive, and provide clear instructions and feedback to students, thereby enhancing the overall educational experience.

It may be beneficial to provide additional support for students who are less able to manage their own learning. Offering workshops on study skills, time management, and self-regulation, as well as fostering a sense of community within online courses, may help improve the learning experience for students who struggle with autonomy.

Further studies should explore additional factors that could influence students' perceptions of educational quality, such as the quality of instructor-student interaction, technological accessibility, and peer collaboration in online environments.

Conducting longitudinal studies could also help in understanding the long-term impact of autonomous learning on educational outcomes.

Based on individual learning styles and levels of autonomy, offering personalized learning paths and adaptive learning technologies could help cater to diverse student needs, ensuring that all students could succeed in an online learning environment.

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