Investigating How Students Perceive Assessment in the Context of Engineering Education

Ousman, Badjie[a]; Yogesh, Velankar[b], and Md. Abdullah, Al Mamun[c.]
School for Sustainable Futures, Amrita Vishwa Vidyapeetham, Amritapuri, Kollam, Kerala, India [ab],
Department of Technical and Vocational Education (TVE), Islamic University of Technology (IUT), Gazipur, Dhaka, Bangladesh [c]
Corresponding Author Email: yogeshvelankar@am.amrita.edu

Abstract

Context

Assessment in engineering education is crucial for evaluating student achievement and teaching effectiveness. Engineering universities should align programs with objectives, curriculum, instruction, and assessment strategies.

Purpose or Goal

Recognizing that students are fundamental in the teaching and learning process, their feedback on content delivery and assessment methods is invaluable for refining and improving the overall instructional process. Consequently, this study investigates students' perceptions of assessment practices in engineering education. This study also examines the significant disparity in the perception of undergraduate engineering students at different academic levels.

Methods

Through a quantitative survey, data was collected from 557 undergraduate engineering students at various academic year levels from six (6) programs across four engineering universities in Bangladesh. Descriptive statistics have been used to get insights into the demographics of the students. Cronbach's alpha was used to assess the reliability of the data. The ANOVA analysis investigates the significant differences in students' perception of assessment practices at different academic levels.

Outcomes

The results show high reliability of the survey instrument with a Cronbach's alpha value of 0.801. The ANOVA findings reveal that first-year students' perceptions of assessment practices differ significantly from third-year and fourth-year students.

Conclusion

We observed that there is a significant variance in the perception of first-year and third-year students on the alignment of assessment with planned learning. Similarly, a significant difference exists between the perception of first-year and fourth-year on the authenticity and transparency in assessment. However, the magnitude of the difference is small.

***Keywords*—** assessment; engineering education; engineering universities; student perception;

I. INTRODUCTION

EMPLOYING suitable assessment approaches aids in cultivating quality graduates for a country. In contrast, discrepancies in assessment methods across engineering institutions can lead to disparities in the caliber of graduates (Stehle & Peters-Burton, 2019). The significance of valid and consistent assessment practices is paramount for the success of formal education (Taber, 2018). To fulfill student anticipations and achieve labour market demands, engineering universities should align their program goals, curriculum, pedagogy, and evaluation strategies to the industry needs (Ali, 2018).

Engineers play a crucial role in shaping our technological, infrastructural, and economic landscapes (Pleasants, 2023). They drive technological advancements, infrastructure development, address global challenges and foster innovation (Raman et al., 2015; Stehle & Peters-Burton, 2019). They are essential in designing and maintaining systems and structures that underpin our daily lives, ensuring that society benefits from technological progress (Jónsson, 2023). Competent engineers possess a unique blend of technical skills and creative problem-solving, enabling innovation and entrepreneurship (Huang-Saad et al., 2018; Sneider, 2016). They contribute to economic growth by creating efficient products, reducing costs, and improving quality of life (McGowan & Bell, 2020). Their role is essential in creating a sustainable, prosperous, and innovative society, as the world becomes interconnected and forms a complex network within (Pleasants, 2023).

Therefore, quality education and training to produce competent engineers are essential for tackling modern challenges (Ali, 2018; McGowan & Bell, 2020; Pleasants, 2023). Providing the graduates with skills, knowledge, and mindset to navigate complex technological, societal, and environmental landscapes should be of importance to achieving a sustainable future. This includes specialization, problem-solving abilities, interdisciplinary collaboration, ethical practices, adaptability, global perspectives, entrepreneurial

https://doi.org/10.52202/073963-0013

innovation, quality assurance, safety, and job market competitiveness (Chen et al., 2021; Nedungadi et al., 2018; Stitt-Bergh et al., 2018). Continuous learning and investment in comprehensive training cultivate a skilled workforce capable of driving progress, solving complex challenges, and contributing positively to the world (Frey et al., 2017; 'Raman et al., 2013; Sneider, 2016). However, despite their enormous efforts, engineering universities continue to encounter difficulties in producing qualified engineers who can fulfill global expectations (Shahid et al., 2022). Effective curricula delivery and assessment methodologies and practices to ensure desired outcomes are one of the challenges faced by these universities (Denton, 1998; Raman et al., 2021; Shahid et al., 2022; Sneider, 2016). Therefore, this paper focuses on exploring the perception of undergraduate students on assessment practices in four (4) engineering universities in Bangladesh. The perception of students was explored in relation to the assessment's Alignment with Planned Learning (APL), Authenticity of the Assessment (AA), Student Consultation on Assessment (SCA), Transparency in Assessment (TA) and Diversity of Assessment (DA)(Koul et al., 2006; Mussawy, 2009; Trochim, 2007; Waldrip et al., 2008) as depicted in Table I.

Assessment in engineering education plays a vital role in shaping the quality, effectiveness, and relevance of engineering programs (Ali, 2018). It involves the systematic evaluation of students' knowledge, skills, and competencies to determine their understanding of engineering concepts and their capability to apply them in practical scenarios (Diwakar et al., 2023; Ghaicha, 2016). Assessment is a multifaceted process that goes beyond measuring rote memorization. It evaluates students' ability to apply knowledge, solve problems, think critically, innovate, collaborate, and uphold ethical standards (Gürdür Broo et al., 2022). Effective assessment enhances the quality of engineering education, produces capable graduates, and supports the continued advancement of the engineering profession (Diwakar et al., 2023). Recognizing that students are at the center of any instructional process, their feedback on content delivery and assessment methods is invaluable for refining and improving the overall instructional process (Jónsson, 2023). Consequently, in this study, we investigated students' perceptions of assessment practices in engineering education. Furthermore, we examined whether there is a significant disparity in the perception of assessment practices among undergraduate engineering students at different academic levels. Measurement scales on the student perception of assessment questionnaire (SPAQ) used in previous studies (Dhindsa et al., 2007; Koul et al., 2006; Mussawy, 2009; Waldrip et al., 2008) to elicit students' perception of assessment practices were used for the data collection. The following hypotheses have been tested to evaluate students' perception of assessment used in undergraduate engineering education programs.

1. Hypothesis 1 (H1): There is no significant difference in the perception of students about the assessment alignment with the planned learning between different academic years.
2. Hypothesis 2 (H2): There is no significant difference in the perception of students about the authenticity of the assessment between different year levels.
3. Hypothesis 3 (H3): There is no significant difference in the perception of students about student consultation on assessment between different year levels.
4. Hypothesis 4 (H4): There is no significant difference in the perception of students on the transparency of assessment between different year levels.
5. Hypothesis 5 (H5): There is no significant difference in the perception of students on the diversity of assessment between different year levels.

II. RELATED WORK

Engaging students in the assessment process is a fundamental shift in education that empowers learners to take an active role in their own educational journey. This approach recognizes students as partners in their learning and fosters a deeper understanding of the learning objectives (Cao & Tech, 2023) (Jogan, 2019). Involving students in assessment process can foster student empowerment, self-regulation, enhanced understanding, feedback, diverse perspectives, co-creation of assessment, individualization, accountability, transparency, improved communication, and preparation for the real world (Ozan, 2019). By actively participating in assessment, students gain a clearer understanding of learning objectives, align their efforts with desired outcomes, and develop metacognitive skills and overall education effectiveness (El-Maaddawy, 2017; Hattingh & Dison, 2020). This approach can foster a growth in mindset and commitment for continuous learning. Students can contribute to setting personalized goals and selecting assessment methods that align with their strengths, interests, and learning preferences (Jogan, 2019). The lack of involving students in assessment can lead to missed opportunities for engagement, authentic learning experiences, feedback, and personalized growth (Raaper, 2023). To foster a holistic learning environment, it is crucial to recognize students as active partners in assessment and to leverage their insights to enhance the overall learning journey (Jónsson, 2023).

Bangladesh's higher education sector faces resource shortages and struggles to improve education standards. Despite government efforts, many institutions struggle with high-quality instruction, poor student learning outcomes, and poor performance in real work environments (Chowdhury, 2016). Assessment plays a critical role in supporting or undermining students' education. Teachers should focus on standardized assessment criteria to better understand students and make informed judgments (Ghaicha, 2016).

Assessment is valid when it aligns with planned learning objectives and is continuous throughout the semester. Studies concerning the learning of engineering students through essay

https://doi.org/10.52202/073963-0013

tests, particularly in the cognitive learning domain, recommend that educators in Bangladesh ought to concentrate on the application, analysis, evaluation, and creation aspects, rather than merely emphasizing recall when dealing with the subdomains within the cognitive domain. (Raihan et al., 2013). To ensure validity in assessment, it should at least address the cognitive, affective, and psychomotor domains of learning (Mohd-Yusof et al., 2015). An authentic assessment simulates a real work environment and evaluates students' ability to apply knowledge in real-world situations (Bhatia et al., 2023; El-Maaddawy, 2017; 'Fan et al., 2015). It aims to build minds capable of performing in social and economic environments. According to Ozan (2019), the implementation of authentic assessment led to a notable enhancement in academic accomplishment and a positive shift in the attitude of aspiring educators toward educational measurement.

Back in 2010, university students in New Zealand voiced apprehensions about their educational journey, primarily due to the prevalence of a grading-centered environment. This culture induced stress, absenteeism, and disrupted coordination (Harland et al., 2015). Educators observed a lack of communication and hesitancy in scaling down assessments. The consensus among academics was that the existing methods curtailed students' capabilities, and they advocated for more manageable assessments. Nonetheless, a single lecturer opined those recurrent assessments that readied students for the demanding real world, even though it constrained their autonomy to explore beyond the set curriculum.

The significance of impartiality in evaluating education outcomes in higher education was highlighted by Zlatkin-Troitschanskaia et al (2019), in which they advised avoiding superficial judgments and utilizing valid, reliable, and transparent assessment and evaluation approaches as diverse learning needs and styles require inclusive assessment approaches (Jónsson, 2023; Stitt-Bergh et al., 2018).

A study conducted by Koul et al (2006), developed and validated a five-scale measurement instrument called Students Perceptions of Assessment Questionnaire (SPAQ) and analyzed the relationship between these scales with students' attitudes toward science. The findings revealed that Congruence with Planned Learning, Authenticity, Transparency, and Diversity were all favorably connected with students' views toward science.

Dhindsa et al (2007), also conducted a study in Brunei where the results showed that students highly perceived Congruence with Planned Learning (CPL) and Transparency in Assessment (TA), Assessment Applied Learning (AAL), and Transparency in Assessment (TIA). However, students had a low perception of Student Consultations, which contradicts the findings of Mussawy (2009), which states that authenticity of the assessment (AA) has the highest perception. Students also had low perceptions of Students Consultation on Assessment (SCA) and Transparency in Assessment (TA).

Hence, taking into account the viewpoints expressed in existing literature regarding the utilization of SPAQ and the significance of gathering students' perceptions on assessment practices to guide instructional content, pedagogies, and assessment approaches, it is appropriate we undertook a study of this nature within the realm of engineering education in the context of Bangladesh.

III. METHODOLOGY

We adopted a quantitative methodological approach in our study. By conducting a survey, a substantial volume of data was collected from four (4) different engineering universities in Bangladesh, comprising both teachers and students. Nonetheless, the outcomes and insights presented in this study are drawn exclusively from the dataset involving students.

Bangladesh has many engineering universities, encompassing both public and private institutions. The investigation centers on four (4) different engineering universities (designated as U1, U2, U3, and U4). The selection of these universities was deliberate, taking into consideration their unique attributes and also the convenience of the data collection process. U1 was singled out due to its diverse student and faculty composition, being an international institution that welcomes learners from over twenty nations. U2 was chosen for its specialized approach to student training as a public university, with a primary focus on cultivating professional engineers across various disciplines. Its admission policy exclusively admits diploma engineers to pursue degree-level studies. U3's inclusion is attributed to its specialization in textile engineering programs, making its student body significant for this study, given Bangladesh's substantial textile industry. Lastly, U4 was designated to represent the domain of private engineering universities of Bangladesh. All these universities are situated in the Dhaka Division of Bangladesh. The study specifically targeted six engineering departments, namely Electrical and Electronic Engineering (EEE), Computer Science and Engineering (CSE), Mechanical Engineering (ME), Civil Engineering (CE), Textile Engineering (TE), and Industrial and Production Engineering (IPE). Only the undergraduate engineering students were selected from these universities via convenience sampling method.

A. Data Collection Instrument

We used SPAQ instrument, developed and validated by Koul et al (2006) and Waldrip et al (2008), to investigate how students perceive assessment practices in Bangladesh. Additionally, Dhindsa et al (2007) and Mussawy (2009) further substantiated the instrument's reliability and validity. With slight adjustments, we used the 22 items SPAQ instrument with a Likert scale ranging from 1 to 5 (1 representing "strongly disagree," 2 indicating "disagree," 3 representing "neutral," 4 signifying "agree," and 5 denoting "strongly agree").

B. Data collecting Procedure

Prior approval from the relevant authorities of the selected institutions has been taken before the data collection. Upon obtaining approval, participants were informed about their

https://doi.org/10.52202/073963-0013

.

TABLE I
SCALES OF MEASUREMENT

Scale	Description
Alignment with planned learning	The extent to which learning program e goals, objectives, and activities are aligned with assessment tasks.
Authenticity	The extent to which assessment tasks are relevant to the learner and also features real-life situations.
Student Consultation	The extent to which students are consulted and informed about the forms of assessment tasks.
Transparency	The extent to which assessment tasks are well-defined and clear to the learner.
Diversity	The extent to which all students have an equal chance at completing assessment tasks.
Alignment with planned learning	The extent to which assessment tasks align with the goals, objectives, and activities of the learning program.

voluntary participation and the option to withdraw from the study at any time. It was emphasized that the collected data would be utilized exclusively for academic purposes. A Google form was developed and its link was distributed to educators and student leaders, as well as shared on specific social media platforms utilized by students for educational purposes. The Google form remained accessible for a duration of two (2) months. A total of 557 respondents completed the questionnaire, and their provided answers were meticulously examined to derive conclusive findings.

C. Analysis

Various statistical techniques were utilized to contextualize and comprehend the collected data, as well as to discern the respondents' demographics. Cronbach's alpha reliability test was executed to gauge the internal consistency of the instrument items. Employing descriptive analysis, the percentage distribution of respondents was depicted concerning gender, academic year, and academic program. An assessment was made to identify the significant outliers and the normal distribution of the dataset to ensure its integrity. To confirm or refute the stipulated hypothesis, an Analysis of Variance (ANOVA) together with Leven's test was carried out, aiming to ascertain significant variations in the means and similarity of the variances respectively. The significant value (p) was considered to be < .05 throughout the analysis.

IV. RESULTS AND DISCUSSION

Reliability analysis was conducted on each of the 5 item variables or constructs (APL, AA, SCA, TA and DA) using Statistical Package for Social Sciences (SPSS) version 26 software. Cronbach's Alpha showed in Table II that the reliability of each construct in the questionnaire (SPAQ) exceeded the minimum standard value of $\alpha = .7$ indicating an acceptable level of internal consistency (Taber, 2018).

TABLE II
RELIABILITY STATISTICS

Construct	No of Item	Cronbach's alpha
APL	4	.775
AA	4	.755
SCA	4	.732
TA	6	.751
DA	4	.798
Overall Reliability	22	.874

A. Descriptive Statistics

There were 82.41% of the participants were male and 17.59% were female from the 557 participants. The students were from six engineering departments, with 17.41% affiliated with Computer Science and Engineering, 13.10% from Electrical and Electronic Engineering, 8.62% from Mechanical Engineering, 8.62% from Industrial and Production Engineering, 17.05% from Civil Engineering, and 35.19% from Textile Engineering. Furthermore, the student population was distributed across various academic years: 15.62% represented the first-year cohort, 15.79% were second-year students, and 38.78% and 29.80% were in their third and fourth-year students respectively.

B. Assessment of Outliers and Normal Distribution

As revealed, the scores within each measurement scale or construct demonstrate the absence of significant outliers (Hoaglin & Iglewicz, 1987). Moreover, the assumption of a data normality within each construct was satisfied, with skewness and kurtosis values ranging from -.735 to .422 and -.826 to .816 respectively, falling within acceptable limits (Demir, 2022). Ideally, both the skewness and kurtosis coefficients must be zero for normally distributed data. However, given that skewness and kurtosis values mostly deviate from zero, acceptable thresholds are defined for these values. Various studies suggest different ranges for these thresholds. However, most studies propose that the ranges should be less than ±2 (Demir, 2022; Field, 2013; George & Mallery, 2010; Gravetter et al., 2020; Trochim, 2007).

C. Test of Hypotheses

1) H1: Alignment with the Planned Learning (APL)

One-way ANOVA analysis was conducted to compare students' perceptions of the assessment's APL across different academic year levels as shown in Table III. The assumption of equal variance was met, as evidenced by Levene's test result $F(3, 553) = .942$, $p > .05$. Notably, a statistically significant distinction in students' perceptions emerged across distinct year levels concerning the assessment's APL ($F(3, 553) = 3.163$, $p < .05$). The observed difference in means and effect size indicated a small effect size (partial eta squared = .017), suggesting that 1.7% of the variability in APL scores could be explained by year levels. Upon further analysis using the Tukey honestly significant difference (HSD) test for post hoc comparisons, we found that the mean score for the first-year

https://doi.org/10.52202/073963-0013

TABLE III
ONE-WAY ANOVA RESULTS OF H1: APL

Test of Homogeneity of Variance					One-Way ANOVA Results		
Year Level	Mean	Standard Deviation	Levene's Statistics	Sig(p)	F	Sig(p)	η²p
First-year	3.8937	.59017	F (3, 553) = .942	.420	F (3, 553) = 3.163	.024	.017
Second year	3.7045	.65164					
Third year	3.6481	.67085					
Fourth-year	3.6943	.59313					

Group Difference				
Year Level	Mean Difference	Sig(p)	95% Confidence Interval	
			LB	UB
First – Third year	.24553*	.013	.0384	.4527

(M = 3.8937, SD = .59017) students significantly differed from that of the third-year students (M = 3.6481, SD = .67085), p < .05. However, no significant differences were observed between the second year (M = 3.7045, SD = .65164) and the fourth year (M = 3.6943, SD = .59313), nor between the second and fourth year, and first and third year.

2) H2: Authenticity of Assessment (AA)

One-way ANOVA was again conducted to compare students' perceptions of the AA across different academic year levels as shown in Table IV. The assumption of equal variance was met, as evidenced by Levene's test result F (3, 553) = 1.181, p > .05. Notably, there is a statistically significant variance in students' perceptions across distinct year levels concerning AA, (F (3, 553) = 3.642, p < .05). The observed difference in means and effect size indicated a small effect (partial eta squared = .019), suggesting that 1.9% of the variability in AA scores could be explained by year levels. Further analysis using the Tukey HSD test for post hoc comparisons found that the mean score for the first-year students (M = 3.6293, SD = .90128) significantly differed from that of the fourth-year students (M = 3.2892, SD = .83210), p < .05. However, no significant differences were observed between the second year (M = 3.3494, SD = .76896) and the third year (M = 3.4595, SD = .80791), nor between the second and third year, and first and fourth year.

3) H3: Student Consultation on Assessment (SCA)

Through a one-way ANOVA analysis, students' perceptions of SCA across different academic year levels were examined as shown in Table V. The assumption of equal variance was met, as evidenced by Levene's test result F (3, 553) = .736, p > .05. Notably, there was no statistically significant variance in students' perceptions across the different year levels concerning SCA, (F (3, 553) = 1.695, p > .05).

4) H4: Transparency of Assessment (AA)

A one-way ANOVA analysis was also conducted to compare students' perceptions of the TA across different academic year levels as shown in Table VI. The assumption of equal variance was met, as evidenced by Levene's test result F (3, 553) = 1.408, p > .05. Notably, a statistically significant difference in students' perceptions emerged across different year levels concerning TA, (F (3, 553) = 2.723, p < .05). The observed difference in means and effect size indicated a small effect (partial eta squared = .015), suggesting that 1.5% of the variability in TA scores could be explained by year levels. Upon further analysis using the Tukey HSD test for post hoc comparisons, we found that the mean score for the first-year students (M = 3.8276, SD = .79746) significantly differed from that of the fourth-year students (M = 3.5612, SD = .70718), p < .05. However, no significant differences were observed between the second year (M = 3.6307, SD = .72514) and the third year (M = 3.6883, SD = .70732), nor between the second and third year, and the first and fourth year.

5) H5: Diversity of Assessment (DA)

One-way ANOVA analysis was finally conducted to compare students' perceptions of DA across different academic year levels as shown in Table VII. The assumption of equal variance was met, as evidenced by Levene's test result F (3, 553) = .254, p > .05. Notably, there was no statistically significant variance in students' perceptions across distinct year levels concerning DA, (F (3, 553) = 2.134, p > .05).

Based on the ANOVA findings presented in Tables III, IV, and VI, it can be deduced that a statistically significant distinction prevails in the perceptions of undergraduate engineering students concerning assessment practices related to APL, AA, and TA. The associated p-values are .024, .013, and .043, respectively, all of which fall below the established threshold for statistical insignificance (p = .05). Consequently, hypotheses H1, H2, and H4 are rejected, as documented in sources like Field (2013), George & Mallery (2010), and

TABLE IV
ONE-WAY ANOVA RESULTS OF H2: AA

Test of Homogeneity of Variance					One-Way ANOVA Results		
Year Level	Mean	Standard Deviation	Levene's Statistics	Sig	F	Sig	η^2p
First-year	3.6293	.90128	F (3, 553) = 1.181	.316	F (3, 553) = 3.642	.013	.019
Second year	3.3494	.76896					
Third year	3.4595	.80791					
Fourth-year	3.2892	.83210					

Group Difference				
Year Level	Mean Difference	Sig	95% Confidence Interval	
			LB	UB
First – Fourth year	.34015*	.010	.0590	.6213

TABLE V
ONE-WAY ANOVA RESULTS OF H3: SCA

Test of Homogeneity of Variance					One-Way ANOVA Results	
Year Level	Mean	Standard Deviation	Levene's Statistics	Sig	F	Sig
First-year	3.7443	.87436	F (3, 553) = .736	.531	F (3, 553) = 1.695	.167
Second year	3.4915	.82128				
Third year	3.6157	.82118				
Fourth-year	3.5346	.85054				

TABLE VI
ONE-WAY ANOVA RESULTS OF H4: TA

Test of Homogeneity of Variance					One-Way ANOVA Results		
Year Level	Mean	Standard Deviation	Levene's Statistics	Sig	F	Sig	η^2p
First-year	3.8276	.79746	F (3, 553) = 1.408	.240	F (3, 553) = 2.723	.043	.015
Second year	3.6307	.72514					
Third year	3.6883	.70732					
Fourth-year	3.5612	.70718					

Group Difference				
Year Level	Mean Difference	Sig	95% Confidence Interval	
			LB	UB
First–Fourth year	.26634*	.029	.0191	.5135

Gravetter et al. (2020). Nevertheless, there is no notable statistical difference observed with regard to student perception in SCA and DA, where the corresponding p-values stand at .167 and .095 respectively. Hence, hypotheses H3 and H5 are failed to reject (Field, 2013; George & Mallery, 2010; Gravetter et al., 2020).

Furthermore, we delved into group disparities to illustrate variations among different year levels. This was accomplished by conducting supplementary examinations utilizing the Tukey

https://doi.org/10.52202/073963-0013

TABLE VII
ONE-WAY ANOVA RESULTS OF DA

Test of Homogeneity of Variance					One-Way ANOVA Results	
Year Level	Mean	Standard Deviation	Levene's Statistics	Sig	F	Sig
First-year	3.1897	.91178	F (3, 553) = .254	.858	F (3, 553) = 2.134	.095
Second year	3.0313	.85921				
Third year	3.2778	.87260				
Fourth-year	3.1084	.85253				

HSD test for post hoc comparisons. The outcomes of this analysis revealed statistically significant mean differences between first and third-year students in their assessment perception score for APL (M = .24553*, p = .013). Similarly, a considerable divergence in perception score emerged between first and fourth-year students in both AA and TA, showcasing a mean difference of (M = .34015*, p = .010) and (M = .26634*, p = .029) correspondingly.

Notably, no additional assessments were undertaken for SCA and DA, as the perceptions of students within these constructs did not present any statistically significant differences as the p-values are .167 and .095 respectively. However, this does not validate the notion that students have reached to a consensus that the assessment practices take into account students' viewpoints and involve consultation between educators and students in assessment-related decisions. In fact, students perceived the DA as the lowest scale with an average mean score of 3.1746, which exhibited agreement in their viewpoint regarding less inclusivity and diversity of the assessment practices compared to other scales. They believe that assessment practices lack the inclusion of a broad array of approaches. Furthermore, despite the differences in their perception of APL, AA and TA, students still consider APL, TA and AA to be the highly observed scale with an average mean value of 3.7092, 3.6613 and 3.4179 respectively. However, the findings of this study confirmed the results of Mussawy (2009).

V. CONCLUSION

The SPAQ has been used in K-12 education settings and at the time of this study we have not come across any study that uses SPAQ in engineering higher education. Furthermore, we observed that there is a significant variance in the perception of first-year and third-year students on the alignment of assessment with planned learning. Similarly, a significant difference exists between the perception of first-year and fourth-year on the authenticity and transparency in assessment. However, the magnitude of the difference is small. Therefore, this study has depicted the significant importance of involving students in decision-making on assessment practices in engineering education as it will further enhance their learning capabilities. Additionally, assessment practices have to be inclusive and authentic. Further studies may explore online assessment practices in engineering education. The perception of teachers can also be explored and compared to that of the students for a better understanding of assessment practices in engineering education context.

ACKNOWLEDGMENT

The authors would like to thank the E4LIFE International Ph.D. Fellowship Program offered by Amrita Vishwa Vidyapeetham, Kerala, India. We extend our gratitude to the Amrita Live-in-Labs® academic program for providing all the necessary support. We also like to thank the Department of Technical and Vocational Education, Islamic University of Technology (IUT), Dhaka, Bangladesh for facilitating the conduct of this study.

REFERENCES

Ali, L. (2018). The Design of Curriculum, Assessment and Evaluation in Higher Education with Constructive Alignment. *Journal of Education and E-Learning Research*, *5*(1), 72–78. https://doi.org/10.20448/journal.509.2018.51.72.78

Bhatia, S., Elhadad, S., Deshmukh, A., Yellela, M. K., & Vangala, O. S. R. (2023). Hack the Problem: A Problem-Based Learning Approach for Ethical Hacking and Network Defense Curriculum. *SIGCSE 2023 - Proceedings of the 54th ACM Technical Symposium on Computer Science Education*, *2*, 1346. https://doi.org/10.1145/3545947.3576292

Cao, M. Y., & Tech, V. (2023). *A Comparative Literature Review: Comparing Approaches to Teamwork Assessment in Engineering Education in the US and China*.

Chen, C. H., Hung, H. T., & Yeh, H. C. (2021). Virtual reality in problem-based learning contexts: Effects on the problem-solving performance, vocabulary acquisition and motivation of English language learners. *Journal of Computer Assisted Learning*, *37*(3), 851–860. https://doi.org/10.1111/jcal.12528

Chowdhury, F. (2016). Employment of Active Learning at HEIs in Bangladesh to Improve Education Quality. *International Education Studies*, *9*(10), 47. https://doi.org/10.5539/ies.v9n10p47

Demir, S. (2022). Comparison of Normality Tests in Terms of Sample Sizes under Different Skewness and Kurtosis Coefficients. *International Journal of Assessment Tools in Education*, *9*(2), 397–409. https://doi.org/10.21449/ijate.1101295

Denton, D. D. (1998). Engineering education for the 21st century: Challenges and opportunities. *Journal of Engineering Education*, *87*(1), 19–22. https://doi.org/10.1002/j.2168-9830.1998.tb00317.x

Dhindsa, H. S., Omar, K., & Waldrip, B. (2007). Upper Secondary Bruneian Science Students' Perceptions of Assessment. *International Journal of Science Education*, *29*(10), 1261–1280.

Diwakar, S., Kolil, V. K., Francis, S. P., & Achuthan, K. (2023). Intrinsic and extrinsic motivation among students for laboratory courses - Assessing the impact of virtual laboratories. *Computers & Education*, *198*, 104758. https://doi.org/10.1016/j.compedu.2023.104758

El-Maaddawy, T. (2017). Innovative assessment paradigm to enhance student learning in engineering education. *European Journal of Engineering Education*, *42*(6), 1439–1454. https://doi.org/10.1080/03043797.2017.1304896

'Fan, X., 'Zhou, J., & 'Tong, M. (2015). Teaching Methods of Engineering Practice Course for Senior Undergraduate Students. *2015 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE),* 111–114.

Field, Andy. (2013). *Discovering statistics using SPSS.* (3th ed.). Sage Publications.

Frey, M., Pokkiyarath, M., Mohan, R., Sai Shibu, N. B., Gracia, V. C., Mohan, V., & Siddhan. (2017). Elevating education of India's rural village girls through distance learning technology supported by sustainable electricity. *GHTC 2017 - IEEE Global Humanitarian Technology Conference, Proceedings*, *2017-January*, 1–8. https://doi.org/10.1109/GHTC.2017.8239300

George, D., & Mallery, P. (2010). *SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 Update* (10th, illustrated ed.). Allyn & Bacoon.

Ghaicha, A. (2016). Theoretical Framework for Educational Assessment: A Synoptic Review. *Journal of Education and Practice*, *7*(24), 2222–1735.

Gravetter, F. J., Wallnau, L. B., Forzano, L.-A. B., & Witnauer, J. E. (2020). *Essentials of statistics for the behavioral sciences.* (10th ed.). Cengage Learning.

Gürdür Broo, D., Kaynak, O., & Sait, S. M. (2022). Rethinking engineering education at the age of industry 5.0. *Journal of Industrial Information Integration*, *25*. https://doi.org/10.1016/j.jii.2021.100311

Harland, T., McLean, A., Wass, R., Miller, E., & Sim, K. N. (2015). An assessment arms race and its fallout: high-stakes grading and the case for slow scholarship. *Assessment and Evaluation in Higher Education*, *40*(4), 528–541. https://doi.org/10.1080/02602938.2014.931927

Hattingh, T., & Dison, L. (2020, November 16). Exploring student perspectives on assessment practices in an engineering context. *2020 IFEES World Engineering Education Forum - Global Engineering Deans Council, WEEF-GEDC 2020*. https://doi.org/10.1109/WEEF-GEDC49885.2020.9293656

Hoaglin, D. C., & Iglewicz, Boris. (1987). Fine-Tuning Some Resistant Rules for Outlier Labeling. *Journal of the American Statistical Association* , *82*(400), 1147–1149.

Huang-Saad, A. Y., Morton, C. S., & Libarkin, J. C. (2018). Entrepreneurship Assessment in Higher Education: A Research Review for Engineering Education Researchers. *Journal of Engineering Education*, *107*(2), 263–290. https://doi.org/10.1002/jee.20197

Jogan, S. N. (2019). "ASSESSMENT FOR LEARNING OR OF LEARNING: A PERCEPTION OF TRAINEES." In *Journal Homepage: International Journal of Research in Social Sciences* (Vol. 9, Issue 1). http://www.ijmra.us,http://www.ijmra.us,

Jónsson, Í. R. (2023). Student involvement in assessment and power relations: teacher's perspective. *Pedagogy, Culture and Society*. https://doi.org/10.1080/14681366.2023.2186930

Koul, R., Fisher, D., & Earnest, J. (2006). Using Student Perceptions in Development, Validation and Application of an Assessment Questionnaire. *Proceedings of the 2006 Conference of the Australian Association of Environmental Education* , 294–305.

McGowan, V. C., & Bell, P. (2020). Engineering Education as the Development of Critical Sociotechnical Literacy. *Science and Education*, *29*(4), 981–1005. https://doi.org/10.1007/s11191-020-00151-5

Mohd-Yusof, K., Ahmad Helmi, S., Aliah Phang, F., & Mohammad, S. (2015). Future Directions in Engineering Education: Educating Engineers of the 21st Century. In *ASEAN Journal of Engineering Education* (Vol. 2, Issue 1).

Mussawy, S. A. J. (2009). *Assessment Practices: Student's and Teachers' Perceptions of Classroom Assessment*. University of Massachusetts Amherst.

Nedungadi, P., Mulki, K., & Raman, R. (2018). Improving educational outcomes & reducing absenteeism at remote villages with mobile technology and WhatsAPP: Findings from rural India. *Education and Information Technologies*, *23*(1), 113–127. https://doi.org/10.1007/s10639-017-9588-z

Ozan, C. (2019). The effect of authentic assessment on academic achievement and attitude towards educational measurement and opinions of prospective teachers. *International Journal of Evaluation and Research in Education*, *8*(2), 299–312. https://doi.org/10.11591/ijere.v8i2.18564

Pleasants, J. (2023). Rethinking the Nature of Engineering: Attending to the Social Context of Engineering. *Science and Education*. https://doi.org/10.1007/s11191-023-00445-4

Raaper, R. (2023). Students as consumers? A counter perspective from student assessment as a disciplinary technology. In *Neoliberalism and Education* (1st Edition, pp. 1–16). Routledge.

Raihan, M. A., Shamim, R. H., Clement, C. K., & Lock, H. S. (2013). A STUDY ON ASSESSMENT & EVALUATION OF ENGINEERING STUDENTS' LEARNING BY ESSAY TEST BASED ON THE COGNITIVE DOMAIN OF BLOOM'S. *International Journal of Advances in Engineering & Technology, Mar*, *6*(1), 1–11.

'Raman, R., 'Achuthan, K., & 'Nedungadi, P. (2013). Virtual Labs in Engineering Education: Modeling Perceived Critical Mass of Potential Adopter Teachers. *Scaling up Learning for Sustained Impact: 8th European Conference on Technology Enhanced Learning, EC-TEL 2013*, 288–300.

Raman, R., Sairam, B., Veena, G., Vachharajani, H., & Nedungadi, P. (2021). Adoption of online proctored examinations by university students during COVID-19: Innovation diffusion study. *Education and Information Technologies*, *26*(6), 7339–7358. https://doi.org/10.1007/s10639-021-10581-5

Raman, R., Venkatasubramanian, S., Achuthan, K., & Nedungadi, P. (2015). Computer science (CS) education in Indian schools: Situation analysis using darmstadt model. *ACM Transactions on Computinig Education*, *15*(2). https://doi.org/10.1145/2716325

Shahid, M. A., Rahman, M., & Ahmed, F. (2022). Challenges in Engineering Education: A Review. *Proceedings of the 5th International Conference on Industrial & Mechanical Engineering and Operations Management,* 1–7.

Sneider, C. (2016). Connecting Science and Engineering Education Practices in Meaningful Ways. Contemporary Trends and Issues in Science Education. In L. A. Annetta & J. Minogue (Eds.), *Grand Challenges for Engineering Education* (1st ed., Vol. 44, pp. 19–35). Springer, Cham.

Stehle, S. M., & Peters-Burton, E. E. (2019). Developing student 21st Century skills in selected exemplary inclusive STEM high schools. *International Journal of STEM Education*, *6*(1). https://doi.org/10.1186/s40594-019-0192-1

Stitt-Bergh, M., Kinzie, J., & Fulcher, K. (2018). *Refining an Approach to Assessment for Learning Improvement*.

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Trochim, W. M. (2007). *The Research Methods Knowledge Base Systems Evaluation View project Systems Evaluation Protocol View project*. http://trochim.human.cornell.edu/kb/index.htm

Waldrip, B. G., Fisher, D. L., & Dorman, J. P. (2008). Students' perceptions of assessment process: Questionnaire development and validation. *In Proceedings of the 5th International Conference on Science, Mathematics and Technology Education*, 561–568.

Zlatkin-Troitschanskaia, O., Schlax, J., Jitomirski, J., Happ, R., Kühling-Thees, C., Brückner, S., & Pant, H. A. (2019). Ethics and Fairness in Assessing Learning Outcomes in Higher Education. *Higher Education Policy*, 537–556.

APPENDIX: SURVEY QUESTIONS

Alignment with planned learning

1. My assessment in engineering courses tests what I understand.
2. My assessment in engineering department tests what I memorize.
3. My assignments/tests are about what I have done in class.
4. I am assessed on what the teacher has taught me.

Authenticity of Assessment

5. I find engineering department assessment tasks are relevant to what I do outside of school.
6. Assessment in the engineering department tests my ability to apply what I know to real-life problems.
7. Assessment in the engineering department examines my ability to answer everyday questions.

Student Consultation on Assessment

8. I can show others that my learning has helped me do things.
9. In the engineering department, I am clear about the types of assessment being used.
10. I am aware of how my assessment will be marked.
11. My teacher does explain to me how each type of assessment is to be used.
12. I can have a say in how I will be assessed in the engineering department through the assessment system.

Transparency in Assessment

13. I am told in advance when I am being assessed.
14. I am told in advance on what I am being assessed.
15. I am clear about what my teacher wants in my assessment tasks.
16. I know how particular assessment tasks will be marked.
17. My relation with the teacher does not have any influence on my assessment scores.
18. I am always provided with the feedback by the teacher on my assessment.

Diversity in Assessment

19. I can complete the assessment tasks by the given time.
20. I am given a choice of assessment tasks.
21. I am given assessment tasks that suit my ability.
22. When I am confused about an assessment task, I am given another option to answer it.

https://doi.org/10.52202/073963-0013