

ORIGINAL ARTICLE

Perspectives of Undergraduate Medical Students Towards Electronic Portfolios: A Mixed-Methods Study from Pakistan

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ABSTRACT

Objective: To explore undergraduate medical students' perspectives on the adoption of electronic portfolios (e-portfolios), focusing on perceived benefits, challenges, and influence on learning and professional growth.

Study Design: A convergent mixed-methods design was employed.

Place and Duration of Study: Bahria University College of Medicine, Bahria University Health Sciences Campus, Islamabad, Pakistan, from May 27, 2025 to January 30, 2026.

Materials and Methods: All 100 first-year MBBS students were invited through census sampling and all participated. A structured questionnaire assessed awareness, perceptions, perceived benefits, and barriers to e-portfolio use. Semi-structured interviews with 21 purposively selected students explored these experiences in greater depth. Quantitative data were analysed using descriptive and inferential statistics; qualitative data underwent thematic analysis.

Results: Only 8% of students used the institutional e-portfolio. Educational background was not associated with use (Fisher's Exact Test, $p = 1.000$). Overall perceptions were positive (mean composite score 23.84 of 30): 63% high, 36% moderate, and 1% low. Female students scored higher than male students on the Mann-Whitney U test ($p = 0.042$), although this should be interpreted cautiously because the parametric analysis was not significant (Welch's t-test, $p = 0.069$). Lack of awareness (42.4%) was the commonest barrier, followed by perceived irrelevance to undergraduate education (19.0%) and uncertainty regarding expected use (12.9%). Greater support and guidance (46.8%) and evidence of educational benefit (26.0%) were the measures most often endorsed to encourage future use. Thematic analysis generated four themes: Knowledge Acquisition and Self-Awareness, Skill Development and Reflective Practice, Learning from Mistakes and Growth Mindset, and Necessary Support Structures.

Conclusion: Medical undergraduates held predominantly positive perceptions of e-portfolios despite limited experience of their use. Improving awareness, structured orientation, faculty support, and curricular integration may enhance meaningful adoption in undergraduate medical education.

Key Words: Education, Medical, Undergraduate; Portfolio; Self-Assessment; Students, Medical; Pakistan.

Introduction

Electronic portfolios (e-portfolios) are defined as digital collections of documents, reflections, multimedia, and other artefacts that demonstrate an individual's learning progression, skills, achievements, and professional development.¹ In medical education, e-portfolios support

competency-based medical education (CBME) by enabling students to document clinical performance, track competency attainment, link learning activities with intended outcomes, and compile evidence of achievement.² They also promote self-regulated learning by encouraging learners to set goals, monitor their progress, reflect on feedback, and identify areas for improvement.³

E-portfolios facilitate critical appraisal of learning experiences and contribute to lifelong learning through structured reflective practice, while continuous documentation of personal and professional growth supports professional identity formation.⁴ They offer flexibility, portability, and real-time updating, overcoming many limitations of paper-based documentation. Internationally, undergraduate and postgraduate programmes have

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adopted e-portfolios to support assessment for learning, enhance reflection, and foster professional development. However, their integration at the undergraduate level remains inconsistent in many countries, including Pakistan, where no national framework currently guides their use.⁵

Consistent with these educational principles, existing literature has shown that although e-portfolios have the potential to improve engagement, self-regulated learning, reflective capacity, competency development, and professional readiness, student utilisation often depends on institutional support, technological reliability, training, and clarity of expectations.⁶ Studies report that many medical undergraduates perceive e-portfolios as an added burden because of variability in technology, perceived usability issues, limited faculty involvement, and uncertain relevance to assessments.^{7,8} Evidence also suggests that early integration within the curriculum, structured reflection opportunities, and mentor guidance promote deeper engagement and more meaningful learning experiences.⁹⁻¹¹ Additional findings highlight variability in the quality of entries and challenges related to originality and standardisation of portfolio content.^{3,12}

Despite documented benefits, several barriers remain common globally. Students frequently cite time constraints, lack of structural clarity, technological difficulties, and insufficient training as key impediments to sustained use.¹³⁻¹⁵ Concerns regarding privacy, consistency in portfolio design, and fear of misinterpretation of personal reflections also hinder engagement.¹⁶ Faculty-related factors further influence adoption; inadequate faculty training, inconsistent feedback practices, and limited understanding of the pedagogical role of portfolios adversely affect student perceptions.¹⁷⁻¹⁹ Successful implementation therefore requires institutional commitment, clear guidelines, robust technical infrastructure, and continuous faculty development.²⁰⁻²² Innovative approaches such as gamification, social-media-supported portfolios, and enhanced feedback mechanisms have been proposed to strengthen motivation, collaboration, and learning.^{13,23}

Despite growing global interest, limited research exists on e-portfolio perceptions among Pakistani

medical undergraduates. The absence of empirical data restricts informed planning and hinders the development of structured, context-appropriate e-portfolio systems aligned with national curricular needs. This gap underscores the need to explore student attitudes, barriers to adoption, and factors influencing engagement in the local setting. Therefore, there was research gap regarding context-specific insights that could guide curriculum developers and institutional leaders in designing effective, student-centred e-portfolio systems.

The aim of this study was to identify medical undergraduates' perceptions of e-portfolios, identify barriers to their adoption, and determine factors influencing engagement, in order to inform effective integration into undergraduate medical education in Pakistan.

Materials And Methods

A convergent mixed-methods research study was conducted at Bahria University College of Medicine, Bahria University Health Sciences Campus, Islamabad, Pakistan, over a period of eight months from May 27, 2025 to January 30, 2026. Ethical approval was obtained from the Ethics Review Committee of Bahria University College of Medicine (Approval No. BUCM/ERC/2502, dated 26 May 2025).

No formal sample size calculation was performed because the entire target population was included. First-year students were selected because institutional implementation of e-portfolios was planned to commence from first-year, making this cohort the most relevant population for evaluating the acceptability and feasibility of the proposed initiative. The study employed census sampling, whereby quantitative survey findings and qualitative interview findings were collected concurrently, analysed separately, and integrated during interpretation.

All eligible first-year MBBS students ($n = 100$) were invited to participate, and all students responded, resulting in a response rate of 100%. Informed consent was obtained from all participants. Participation was voluntary, and confidentiality and anonymity were maintained throughout the study. Participants were informed of their right to withdraw from the study at any stage without any consequences.

Undergraduate medical students enrolled in the first-year MBBS programme at Bahria University College of Medicine who provided informed consent were included in the study. Students who declined to participate or did not provide informed consent were excluded.

Data were collected using a structured questionnaire adapted from previously published studies by Belcher et al.²⁴ and Bangalan et al.²⁵ The instrument comprised demographic characteristics, system utilisation, barriers to non-use, and two distinct Likert-scale subscales. To ensure psychometric soundness, internal consistency was evaluated separately for both subscales using Cronbach's alpha (α). The first subscale, consisting of six items measuring student perceptions of e-portfolio utility, demonstrated good internal consistency ($\alpha = 0.824$). The second subscale, consisting of seven items evaluating prospective behavioural intentions and reflective learning applications, demonstrated excellent internal consistency ($\alpha = 0.891$).

Because demographic items and categorical barrier checklists represent independent nominal variables rather than continuous scale, reliability metrics were not mathematically applicable to those sections. The analyses reported in this paper are based on the six-item perception subscale, which was combined into a single composite perception score. The questionnaire was administered electronically using Google Forms.

In addition, semi-structured interviews were conducted with 21 purposively selected students, using an interview guide derived from the open-ended questionnaire items, to explore their experiences and perceptions in greater depth.

Quantitative data were analysed using IBM SPSS Statistics v27. Descriptive statistics were reported as frequencies, percentages, means, and standard deviations. Categorical variables were summarised as frequencies and percentages. Because e-portfolio use was reported by only eight participants, and more than 20% of cells in the relevant cross-tabulations had an expected count below 5, the Pearson Chi-square test was not appropriate and all cross-tabulations involving e-portfolio use were analysed using Fisher's Exact Test.

The composite perception score (six items, reverse-coded so that a higher value indicated a more

positive perception; possible range 6 to 30) was assessed for normality using the Shapiro-Wilk test and, being non-normally distributed, was compared between two groups, male versus female and e-portfolio users versus non-users, using the Mann-Whitney U test, with the independent-samples t-test reported for corroboration.

Homogeneity of variance was assessed using Levene's test, and Welch's t-test was used in place of the Student t-test where variances were unequal. Differences in perception scores across the three educational backgrounds (FSc, A Levels, and IB) were examined using the Kruskal-Wallis test, with one-way ANOVA reported alongside. Effect sizes were calculated as Cohen's d. Statistical significance was set at a two-sided p-value of <0.05 , and exact p-values were reported.

Qualitative interview data were analysed using Braun and Clarke's six-phase reflexive thematic analysis approach. Interviews were transcribed with verbatim, and transcripts were read repeatedly to achieve familiarisation. Meaningful units of text were coded independently by two members of the research team, and coding was performed manually. The coders compared their coding frameworks, and discrepancies were resolved through discussion until consensus was reached. Related codes were grouped into categories, and broader themes were generated iteratively.

Data collection and analysis continued until data saturation was reached, defined as the point at which no new codes or themes emerged from successive interviews. Saturation was achieved at participant 18, but interviewing continued with the last participant. Reflexivity was maintained through regular team debriefing, with the researchers acknowledging their position as medical educators to limit the influence of preconceptions on interpretation. The trustworthiness of the qualitative findings was addressed in accordance with the criteria of Lincoln and Guba: credibility through investigator triangulation and the use of participant-derived verbatim quotations, dependability and confirmability through an audit trail of coding decisions, and transferability through a detailed description of the study setting and participants.

Results

The study included 100 undergraduate medical students aged 18 to 24 years (mean = 19.41, SD = 1.14). Females constituted 68% (n = 68) of the participants, whereas males represented 32% (n = 32). Most students reported were with Faculty of Science (FSc) educational background at entry (93%, n = 93), followed by A Levels (6%, n = 6) and the International Baccalaureate (1%, n = 1).

Only 8% (n = 8) of all participants reported any use of the institutional e-portfolio system, while 92% (n = 92) had never used it. Among users, the most frequently accessed section was educational background (87.5%, n = 7), followed by co-curricular activities (37.5%, n = 3) and distinctions (25%, n = 2). Reflective and feedback-oriented sections showed minimal engagement ($\leq 12.5\%$, i.e. ≤ 1 user).

Cross-tabulation of e-portfolio use by educational background demonstrated similar levels of non-usage across FSc (91.4%, n = 85), A Levels (100%, n = 6), and IB (100%, n = 1). Because more than 20% of cells had an expected count below 5, all cross-tabulations were assessed using Fisher's Exact Test. Use of the e-portfolio was not significantly associated with educational background (p = 1.000) or with gender (p = 0.708), nor with agreement on either of the two single-item statements examined (p = 0.385 and p = 1.000). Results of all cross-tabulations are presented in Table I.

A composite perception score was calculated by summing responses to six five-point Likert-scale items, with each item reverse-coded so that a higher value reflected stronger agreement and, therefore, a more positive perception of e-portfolios (possible range 6 to 30). The six items showed good internal consistency (Cronbach's alpha = 0.824), supporting their combination into a single scale.

Scores were categorised a priori into equal intervals as low (6 to 14), moderate (15 to 22), and high (23 to 30). The mean perception score was 23.84 (SD = 3.75), with scores ranging from 14 to 30, indicating an overall positive orientation toward e-portfolios relative to the scale midpoint of 18. Based on these categories, 63% (n = 63) of students demonstrated high perception, 36% (n = 36) moderate perception, and 1% (n = 1) low perception. The distribution of responses to each of the six individual perception statements is shown in Figure 1.

Because perception scores were not normally distributed (Shapiro-Wilk p = 0.007), between-group differences were examined using the Mann-Whitney U test (Table II). Female students reported more positive perceptions than male students (median 24 versus 22; mean 24.37 versus 22.72; Mann-Whitney U, p = 0.042; Cohen's d = 0.45). Although the Mann-Whitney U test reached statistical significance, this finding should be interpreted cautiously, because the parametric analysis did not (Welch's t-test, p = 0.069) and the associated effect size was small.

E-portfolio users reported more positive perceptions than non-users (mean 26.12 versus 23.64; Cohen's d = 0.67), although the difference was not statistically significant (Mann-Whitney U, p = 0.083), a finding consistent with the small number of users (n = 8).

Perception scores did not differ significantly across educational backgrounds (FSc 23.86, A Levels 22.83, IB 28.00; Kruskal-Wallis p = 0.347; one-way ANOVA p = 0.439), as shown in Table III.

Among non-users, the most frequently reported reason for non-engagement was lack of awareness (42.4%, n = 39). Other reasons included perceptions of irrelevance to the undergraduate phase (19.0%, n = 17), uncertainty about expected use (12.9%, n = 12), time constraints (8.6%, n = 8), and technical challenges (7.2%, n = 7). Confidentiality concerns (3.4%, n = 3) and peer non-use (2.4%, n = 2) were rarely cited.

When asked which measures would encourage future use, students most frequently endorsed greater support and guidance (46.8%, n = 44). Additional suggestions included providing evidence of training benefit (26.0%, n = 24), making the portfolio compulsory (14.9%, n = 14), and hearing experiences from junior doctors (12.3%, n = 12). The qualitative component included 21 semi-structured interviews, which produced four main themes.

Knowledge Acquisition and Self-Awareness: participants described the e-portfolio as a tool that enabled them to monitor their academic development. One participant stated, *"It helps me see how much I have improved over time and what I still need to work on."* (Participant 5).

Skill Development and Reflective Practice: students highlighted that documenting experiences encouraged reflection. One participant commented,

"Writing down my experiences made me think about what went well and what I could improve next time." (Participant 12).

Learning from Mistakes and Growth Mindset: participants viewed the e-portfolio as an opportunity to reflect on mistakes and use feedback for continuous improvement. One participant commented, *"It helps me identify where I went wrong so I can learn from my mistakes and avoid repeating them in the future."* (Participant 9).

Necessary Support Structures: participants consistently emphasised the need for institutional guidance. As one student explained, *"We need clear instructions and someone to guide us in using the portfolio effectively."* (Participant 18).

Within these themes, the most frequently mentioned motivator was progress tracking (42.9%, $n = 9$). Other frequently expressed motivators included learning awareness (33.3%, $n = 7$) and goal setting (23.8%, $n = 5$). Regarding support needs, students most requested clearer instructions (52.4%, $n = 11$), followed by regular tutor guidance (28.6%, $n = 6$) and access to exemplar portfolios (19.0%, $n = 4$). Representative participant quotations illustrating each theme are presented in Table IV, and the thematic structure is summarised in Figure 2.

Table I: Association Between E-Portfolio Use and Student Characteristics or Single-Item Responses (Fisher's Exact Test) ($n = 100$)

Cross-tabulation	Fisher's Exact p	% cells with expected count < 5
e-portfolio use × gender	0.708	25%
e-portfolio use × educational background	1.000	50%
e-portfolio use × agreement with the statement "e-portfolios are easier to use in the postgraduate phase"	0.385	50%
e-portfolio use × agreement with the statement "e-portfolios should be used in future assessment (mini-CEX)"	1.000	70%

p values from Fisher's Exact Test. Chi-square were not used because more than 20% of cells had an expected count below 5. The final two rows report agreement with single questionnaire statements and not composite constructs.

Table II: Composite Perception Score by Gender and by E-Portfolio Use (Mann-Whitney U Test and Parametric T-Test) ($n = 100$)

Comparison	Mean ± SD	Median [IQR]	Mann-Whitney p	Parametric p
Male ($n = 32$)	22.72 ± 4.49	22.0 [19.5-25.5]	0.042 *	Welch 0.069
Female ($n = 68$)	24.37 ± 3.25	24.0 [22.0-26.2]		Student 0.040
User ($n = 8$)	26.12 ± 3.00	25.5 [23.8-28.5]	0.083 (ns)	Welch 0.055
Non-user ($n = 92$)	23.64 ± 3.76	24.0 [21.8-26.0]		Student 0.072

Composite perception score is reverse-coded, so a higher score indicates a more favourable perception (possible range 6 to 30). IQR, interquartile range. Gender: Levene's test showed unequal variances ($p = 0.040$), so Welch's test is the appropriate parametric comparison. Effect sizes: gender Cohen's $d = 0.45$ (small); user status Cohen's $d = 0.67$ (moderate to large). * Statistically significant on the non-parametric test only; see text for interpretation

Table III: Composite perception score across educational background (Kruskal-Wallis test and one-way ANOVA) ($n = 100$)

Group	n	Mean ± SD	Median [IQR]
FSc	93	23.86 ± 3.73	24.0 [22.0-26.0]
A Levels	6	22.83 ± 4.17	21.5 [21.0-24.2]
IB	1	28.00	28.0

One-way ANOVA $F = 0.830$, $p = 0.439$. Kruskal-Wallis $H = 2.116$, $p = 0.347$. Kruskal-Wallis is the defensible primary test given the small, unequal groups; no post-hoc test is meaningful because the IB group has a single respondent. Higher score indicates a more favourable perception.

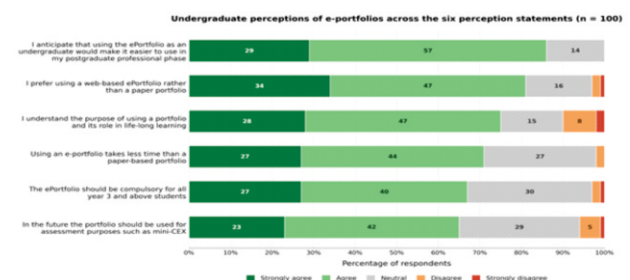


Figure 1: Distribution of Responses to the Six E-Portfolio Perception Statements ($n = 100$).

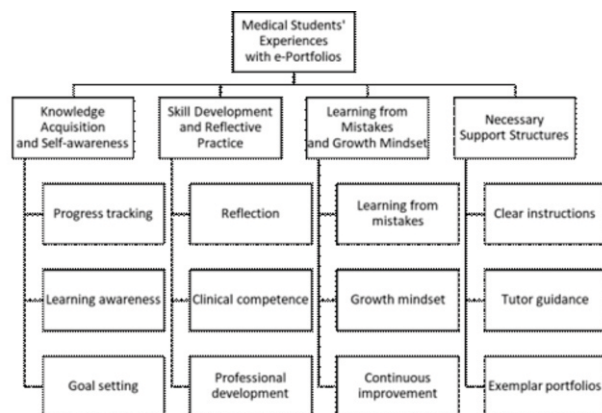
Discussion

The present study identified a marked discrepancy between attitude and behaviour: undergraduate medical students held positive attitudes toward e-portfolios despite very low utilisation (8%) of the institutional system. This gap indicates that deploying digital software alone is not sufficient to

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Table IV: Qualitative Themes, Subthemes, and Representative Participant Quotations (n = 100)

Theme	Subthemes	Representative Quotation
Knowledge Acquisition and Self-Awareness	Progress tracking; learning awareness; goal setting	"It helps me see how much I have improved over time and what I still need to work on." (Participant 5)
Skill Development and Reflective Practice	Reflection; self-assessment; professional development	"Writing down my experiences made me think about what went well and what I could improve next time." (Participant 12)
Learning from Mistakes and Growth Mindset	Learning from mistakes; continuous improvement; goal setting	"It helps me identify where I went wrong so I can learn from my mistakes and avoid repeating them in the future." (Participant 9)
Necessary Support Structures	Clear instructions; tutor guidance; exemplar portfolios	"We need clear instructions and someone to guide us in using the portfolio effectively." (Participant 18)

**Figure 2: Thematic Representation of Medical Students' Experiences With E-Portfolios**

generate active engagement. Students appear more likely to adopt these tools when they are introduced early, integrated into the curriculum, and actively supported by faculty. Our findings are consistent with those of Belcher et al.²⁴ and Bangalan et al.,²⁵ who reported that e-portfolios gain traction only when they are treated as an active medium for teaching and assessment rather than a peripheral

task. The low engagement observed in our cohort is therefore most plausibly explained by the absence of formal orientation and by limited curricular integration.

Our data show that 63% of students recorded high perception scores, 36% moderate scores, and 1% a low score, giving a mean composite score of 23.84 out of 30. Although actual users viewed e-portfolios more favourably than non-users, the difference in composite perception scores did not reach statistical significance. This most likely reflects the small number of users ($n = 8$) rather than a true absence of difference, a pattern commonly observed in early-stage implementation. A similar note of caution applies to the gender comparison; although the Mann-Whitney U test reached statistical significance ($p = 0.042$), this finding should be interpreted cautiously because the parametric analysis did not (Welch's t-test, $p = 0.069$) and the effect size was small (Cohen's $d = 0.45$). Existing literature suggests that students recognise the value of reflective portfolios mainly after they begin using them consistently.^{8,9} This supports embedding portfolio work directly into the learning timeline rather than leaving it as an optional, self-guided activity.

The finding that 92% of Pakistani medical undergraduates had never used the institutional e-portfolio, with 42.4% reporting a lack of awareness of its existence, points to a substantial implementation gap. This lack of awareness is consistent with wider Pakistani and South Asian medical education literature, in which digital initiatives frequently fail to gain traction when introduced without structured onboarding.^{7,18,19}

Reviews of portfolio implementation also describe a time-versus-benefit trade-off, in which assessment-driven medical students give low priority to platforms that are not linked to assessment.¹⁴ Within a competency-based medical education framework that relies on continuous programmatic assessment such as the mini-Clinical Evaluation Exercise (mini-CEX), an e-portfolio that is neither linked to assessment nor compulsory is readily overlooked by students managing a heavy workload. Our data do not support the assumption that students who are familiar with digital technology will spontaneously adopt reflective portfolios. To narrow this gap, and to ease the transition to postgraduate training, where

portfolio-based competency tracking is increasingly adopted,^{12,16} institutions need to move from passive availability to active integration, embedding e-portfolios in clinical schedules, summative assessment, and structured faculty feedback cycles. The quantitative and qualitative components of this study were mutually explanatory rather than independent. The interview accounts help explain why lack of awareness emerged as the dominant quantitative barrier (42.4%), since students repeatedly reported that they did not know the platform existed or how it was intended to help them. Similarly, the qualitative theme Necessary Support Structures corresponds directly to the survey finding that 46.8% of students wanted structured guidance and tutor support. The quantitative observation that users held more favourable perceptions was likewise reflected in the interviews, in which students who had logged in described concrete benefits such as tracking progress, reflecting on clinical skills, and learning from mistakes. This convergence of quantitative and qualitative findings supports the interpretation that low uptake indicates the need for structured guidance and clearer communication, rather than a rejection of the value of the tool.

Limitations

This study has several limitations that should be kept in mind when interpreting the findings. First, the study included a single first-year MBBS cohort at one medical college, recruited through census sampling. Consequently, the findings may not represent the experiences of students in later clinical years, or those at other institutions with different digital resources. Second, the data rely on self-reported questionnaires, which are inherently vulnerable to social desirability and recall bias. Third, because only 8% of the sample had actual experience of using the institutional e-portfolio, most responses represent prospective expectations and theoretical perceptions rather than hands-on, long-term experience with the platform. Fourth, the cross-sectional design captures a single snapshot of student views and cannot track how perceptions, digital literacy, or engagement levels evolve over time. Fifth, the study assessed subjective student perceptions rather than actual educational outcomes; objective markers of success, such as

clinical performance, reflective writing quality, or academic grades, were not measured, so it is not possible to determine whether e-portfolio use translates into improved clinical competence.

Future Recommendations

To establish the e-portfolio as an active educational anchor rather than an underused resource, future initiatives should focus on the following strategies. Firstly, mandatory hands-on e-portfolio orientation modules should be implemented during the first week of medical school to address the lack of awareness identified in this study. Moreover, mentor-guided reflective cycles should be designated, in which faculty review portfolio entries and provide timely, formative feedback.

Furthermore, portfolio tasks should be formally linked to workplace-based clinical assessments such as the mini-CEX, so that the tool is directly tied to academic progress. Finally, multicentre comparative studies should be conducted across Pakistani medical colleges using different integration models. This, alongside longitudinal research, would help determine whether early e-portfolio integration yields long-term benefits for clinical reflective practice, competency tracking, and professional identity development.

Thus, introducing e-portfolios early in the curriculum, supported by structured orientation, faculty mentorship, and integration with competency-based learning and assessment, may improve student engagement and encourage reflective learning. Further multicentre longitudinal studies are needed to evaluate the long-term impact of e-portfolios in undergraduate medical education in Pakistan.

So, this systems would support undergraduate learning needs, strengthen professional development, and address contextual challenges related to technology and training.

Conclusion

Undergraduate medical students recognised the potential educational value of e-portfolios and held predominantly positive perceptions of their use, with 63% scoring in the high-perception category and a further 36% in the moderate category. However, most students had little or no experience with the institutional e-portfolio, resulting in limited utilisation. Lack of awareness, insufficient guidance,

and minimal curricular integration emerged as the main barriers to adoption.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

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