



## RESEARCH ARTICLE

Section: *Digital Humanities***Digital adaptation in Saudi EFL higher education: Technology exposure, student confidence, and rural–urban variation**Mohammed A. Sharaf-Addin<sup>1\*</sup><sup>1</sup>English Language and Literature Department, Prince Sattam Bin Abdulaziz University, Saudi Arabia\*Correspondence: [m.sharafaddin@psau.edu.sa](mailto:m.sharafaddin@psau.edu.sa)**ABSTRACT**

Although Saudi Arabia's Vision 2030 policy has prioritized rapid, large-scale technology integration in higher education, this study examined institutional technology use, students' adaptation challenges, and rural–urban differences in perceptions. A mixed-methods approach was used, including a questionnaire on pedagogical approach, technology diversity, technology usage frequency, perceived increase in technology, students' confidence, benefits, challenges, and perceptions of Vision 2030, along with two open-ended items. A chi-square test found no significant difference in the type of adaptation challenge reported across institutional pedagogical approaches (traditional, blended, or highly technology-based),  $\chi^2 (6, N = 228) = 2.75, p = .840$ . A tool-diversity index (0–5) was not significantly related to reported benefit type but was a significant, albeit weak, ordinal predictor of confidence in using digital tools (Nagelkerke  $R^2 = .019, p = .047$ ). Neither the perceived increase in technology nor the actual frequency was significant when included together (Nagelkerke  $R^2 = .041$ ). No significant differences emerged between rural and urban perceptions or between perceptions of the Vision 2030 environment (all  $p > .26$ ). The open-ended responses revealed three concrete, actionable ideas: introductory technology training, gradual pacing, and device provision. The results indicate that the problems Saudi EFL learners encountered were related not only to institutional technology factors but also to broader factors, such as the transition to university and individual learners' attitudes and confidence. This sample did not strongly support the often-held assumption of rural disadvantages, though the small rural subsample limits the strength of this conclusion.

**KEYWORDS:** digital divide, EFL education, rural-urban disparity, Saudi Arabia, student confidence, technology adoption, Vision 2030

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## 1. Introduction

Digital transformation is a tool that Saudi Arabia's Vision 2030 has called for many times to modernize higher education since its launch in 2016, with specific plans to increase the use of e-learning infrastructure, incorporate digital tools into classroom instruction, and educate students, including EFL graduates, for a new labor market where digital skills and English language proficiency go hand-in-hand (Alqahtani & Albidewi, 2022; Banafi, 2025). However, another stream of policy research shows that Saudi Arabia has experienced a persistent digital divide, in which rural students have less access to digital tools and infrastructure and less prior exposure to digital tools than their urban counterparts (Alenezi & Alenezi, 2025; Saad & Fahim, 2021).

What is missing from this literature is a study that directly correlates the two strands at the level of the individual EFL classroom - that is, the extent to which the technology profile (the pedagogy of the university as a whole, the number of different tools used, and the technology intensity of the classroom in relation to students' experiences in the classroom) ultimately predicts what challenges students report, or how confident and satisfied they feel. Most importantly, it remains unclear whether there is a difference in the digital transformation agenda of Vision 2030 between rural students and students from an urban background that would warrant the assumption that rural students require significantly greater institutional support. Previous studies conducted in Saudi Arabia have shown that blended and technology-enhanced instruction is becoming prevalent (Ben Khalifa et al., 2025; Aldosemani et al., 2019; Ali et al., 2023; Bin Dahmash, 2020); that students in general have positive attitudes towards digital tools (Alqahtani et al., 2022; Alhammad & Alonizi, 2025), and that the digital divide between rural and urban areas exists at the national level of infrastructure (Alenezi & Alenezi, 2025; Zakari et al., 2025). These two areas of work, however, have rarely been tested simultaneously, with measures of institutional technology intensity alongside measures of student-reported challenge types, confidence, and geographic background in a single sample.

### 1.1 Research Questions

Central Research Question: How do institutional technology profiles (pedagogical approach, tool diversity, and intensity relative to prior schooling) and perceived alignment with Vision 2030 relate to the challenges students face and the support they believe is needed, particularly for rural students?

- RQ1: Does the institution's overall pedagogical approach predict the type of challenge students report?
- RQ2: Is tool diversity associated with perceived benefit type and with students' confidence in using digital tools?
- RQ3: Does perceived technology-intensity increase relative to prior schooling predict adaptation challenges, independent of actual frequency of use?
- RQ4: Do students' Vision 2030 perceptions differ significantly by geographic background and by prior English-learning environment?
- RQ5: What themes emerge from open-ended responses regarding institutional support needs, and how do these align with or extend the quantitative findings on rural support?

## 2. Literature Review

### 2.1 Vision 2030, English Language Teaching, and Digital Transformation

In Vision 2030, education reform is based on three pillars: a vibrant society, a thriving economy, and an ambitious nation (Saudi Vision 2030, 2016). The modernization of educational methods and the expansion of digital education are considered part of the preparation of graduates for the labor market and are advocated by Vision 2030 (Alhazmy, 2025; Allmnakrah & Evers, 2020). English language programs (ELPs) have been cited recurrently as a space where digital modernization and Vision 2030's labor market objectives overlap (Al-Seghayer, 2023; Banafi, 2025; Karim & Jamshed, 2023). Furthermore, several studies indicate that while national policy is robust, EFL teachers and supervisors report that translating the policy into consistent classroom technology integration is uneven, as there are still limitations in teacher training, technological effectiveness, and local infrastructure that hinder effective policy implementation (Al-Khresheh et al., 2025; Alshehri et al., 2026; Alruwaili & Grami, 2026).

## *2.2 Institutional Technology Profile and Student Challenges*

Although the use of digital EFL delivery methods like virtual classrooms, Blackboard, blended learning, and technology-enhanced education has become common in Saudi institutions, especially after 2020 (Alsuwat, 2026; Bin Dahmash, 2020; Deen & Mahmoud, 2025), several studies have shown how students still report some accompanying challenges that hinder full implementations of such methods (Alhaider & Nisa, 2023; Aloufi et al., 2026; Alruwaili & Grami, 2026; Bin Dahmash, 2020). Among the reported benefits of online and digital-based learning are flexibility and accessibility (Alhaider & Nisa, 2023; Al-Samiri, 2021), as well as positive attitudes (Alzain, 2022). While the challenges lie in internet and connectivity issues (Alhammad & Alonizi, 2025; Alzain, 2022; Hakim, 2020), technical set-up issues (Hind, 2021), digital unfamiliarity as well as weak technical support (Alhammad & Alonizi, 2025; Hind, 2021), and limited resources as well as university council decisions (Bin Dahmash, 2020). Collectively, these studies show that the effectiveness of technology-enhanced instruction depends on how institutions use technology. This is evident in Ali et al. (2023), who used an experimental design comparing blended and fully online instruction for grammar-skill acquisition among first-year Saudi students and found that, although both approaches significantly improved learners' performance, students in the blended condition achieved significantly higher gains than those receiving fully online instruction.

These studies share a very limited set of common categories of challenges: technical/connectivity problems, unfamiliarity or limited previous experience with digital tools, motivation, and challenges to following remote instruction. These challenge categories directly correspond to the four challenge categories used in the survey instrument employed in this study. These studies have not been designed to statistically determine whether the type of challenge reported is related to the technology use level of the pedagogies of the actual institutions, or whether it is more independent of the overall level of technology use and more dependent on individual-level constructs like prior exposure to the technology or confidence in the technology.

A recurring theme in this literature is the importance of confidence and self-efficacy in using digital tools as an individual-level variable (Wah, 2025; Yuan et al., 2024). In the Saudi Arabian higher education context, research has shown a correlation between self-efficacy and satisfaction and adoption in e-learning and TEL settings (Aldhahi et al., 2022; Alqahtani et al., 2022; Alyoussef & Omer, 2023). This implies that students' views of digital technologies may significantly affect how they interact with e-learning, which this study investigates directly by correlating a tool-diversity index with perceived benefit type and confidence.

## *2.3 The Rural–Urban Digital Divide in the Saudi Context*

In contrast to the ELP-specific literature reviewed above, the broader Saudi digital-divide literature provides a more negative picture of persistent inequalities in digital access across rural and urban areas (Alenezi & Alenezi, 2025; Elmohimeed, 2024; Saad & Fahim, 2021).

Alenezi and Alenezi (2025) reported disparities in digital access between rural and urban schools in the Northern region of Saudi Arabia. When comparing usage across digital delivery platforms, the results showed higher usage percentages among urban learners than among rural learners. Similarly, Al-Khresheh et al. (2025) and Alfalah et al. (2025) frame this gap through the Digital Divide Theory, arguing that geographic and infrastructural disadvantages — rather than individual digital capital alone — drive unequal access to technology in rural Saudi contexts.

Taken together, these studies suggest that factors such as geographical location and socioeconomic conditions play a role in shaping digital inequalities in Saudi Arabia. Although Vision 2030 has accelerated digital transformation, rural communities continue to face barriers that are less evident in the ELP-specific literature.

## *2.4 Institutional Investment and Policy Implementation*

Another strand of research has provided more direct documentation on how Saudi universities have adopted digital technologies from different perspectives, including the effectiveness of e-learning (Rajab, 2018), institutional implementation (Aljaber, 2018), teachers' professional development (Nazim & Alzubi, 2025), and the integration of technology into English language teaching (Albiladi, 2022). The body of institutional-level research, taken as a whole, motivates the present study to regard the diversity of pedagogical approaches and tools as potentially measurable, not taken-for-granted, predictors of student challenge and benefit.

## *2.5 Diffusion of Technology and Perceived versus Actual Change*

Another gap is between real and perceived technology change. Rogers' diffusion of innovation model is still employed in the latest educational-technology research (Frei-Landau et al., 2022). These scholars highlight that adoption decisions and comfort with innovation are subjective and depend on users' perceptions of characteristics such as relative advantage and compatibility, rather than solely on the availability of the technology. If we apply it to the current study, this means that the Saudi EFL learner's perceived relative increase in technology use (item 9) would predict the level of difficulty of adapting to the language, even after controlling for the actual frequency of the technology use (item 8).

## **3. Theoretical Framework**

This study is situated within three complementary ways of thinking. First, Rogers's (Frei-Landau et al., 2022) perspective on diffusion of innovation is applied to interpret the institutional technology profile, pedagogical approach, and tool diversity as an "innovation" that can be adopted and perceived as difficult or not, depending on subjective assessment rather than objective exposure. Second, the concept of confidence in using digital tools is a proximal individual-level construct that may be more impactful on students' outcomes than tool diversity; this motivates RQ2, which tests tool diversity against both benefit type and confidence. Digital Divide Theory is applied here to the concept of rural–urban comparisons for RQ4 and RQ5: it predicts measurable differences in the experience and evaluation of a common Saudi national digital-transformation policy as a function of unequal access and differential capital (digital self-efficacy, social and institutional support), not geography per se and not as a function of the policy itself. These three frameworks in combination create a clear and measurable expectation that (a) if there is a real rural digital divide in this population, it will manifest as measurable differences in perceptions, level of confidence, or level of challenge to the Vision 2030 in rural- versus urban-background students, and (b) that subjective, perceived technology variables may be more powerful predictors of student experience in this population than objective, institutional technology variables.

## **5. Methodology**

### *5.1 Design of the Study*

The study adopted a concurrent mixed-methods design, with a cross-sectional quantitative survey with two open-ended qualitative items. The quantitative research design was correlational and comparative, namely Chi-square tests of association and multinomial logistic regression (RQ1, RQ3); one-way ANOVA and ordinal (PLUM) regression (RQ2); and an independent-samples t-test and one-way ANOVA with Tukey post hoc comparison (RQ4). Qualitative data analysis was carried out from the two open-ended items (RQ5) and involved inductive, keyword-assisted thematic content analysis of the data, which was then cross-tabulated by geographic background to triangulate the rural–urban comparisons.

### *5.2 Instruments of the Study*

The data were gathered through an online Arabic questionnaire administered via Google Forms. Demographic and background variables (gender, age, academic level, location of previous school, and type of previous English-learning environment) were measured. In addition, institutional technology-profile variables were examined, including overall pedagogical approach; a multi-select list of technologies used in class and a tool-diversity index (0–5), developed by summing the presence of smartboards, LMSs, e-books, online discussion tools, and mobile applications; frequency of technology use; and perceived technology increase compared with previous schooling. Moreover, five-point Likert items related to attitude (engagement, initial adaptation difficulty, background effect on adaptation, instructor effectiveness, and motivation) were assessed. In addition, perceived challenge type (single-select): technical issues; limited prior experience; lack of motivation; difficulty following online classes. Perceived benefit type (single-select): easier access to materials; more interaction and feedback; flexible timing; independent learning. Confidence in the use of digital tools (single-select): not confident; somewhat confident; neutral; very confident.

### *5.3 Sampling*

The questionnaire was returned by 233 undergraduate EFL students from a public university in Saudi Arabia

(119 males and 114 females). For the challenge-type variable, five of the 233 responses were free-text or did not fit into any of the four predefined categories. These responses were therefore excluded, leaving 228 valid responses ( $N = 228$ ) for the analyses involving this variable. The majority of respondents were between the ages of 18 and 21 years ( $n = 138$ ) or 22–25 years ( $n = 89$ ) and in the first or second academic level ( $n = 146$ ). As regards the previous school attended, 195 (83.7%) said their background was urban, while 38 (16.3%) said it was rural; this simply reflects the underlying population of the sampled institution and is treated as a limitation in the subsequent analysis based on rural comparison. The sampling method was a non-probability convenience sampling, which was suitable for this study since it is exploratory in nature and used to generate hypotheses; however, generalizability was limited as described in the Limitations section.

#### *5.4 Validity and Reliability*

Content validity was ensured by aligning each survey item directly with a research question and by using response categories that were based on and consistent with those previously validated by Bin Dahmash (2020) and Al-Samiri (2021) in the Saudi EFL and digital-divide literature, respectively. There were two known data quality problems that were addressed and corrected before the data were analyzed: an incorrect response category for the challenge item was corrected to its correct label, and inconsistent trailing whitespace in the Vision 2030 Likert labels was removed before numeric recoding. Questionnaire items were not designed as multi-item scales with Cronbach's alpha internal consistency estimates for some important constructs (challenge type, benefit type, confidence, pedagogical approach) due to this reliability limitation. The three Vision 2030 items were analyzed separately, but given their face validity and content overlap, they were treated as a thematic set. Analysis using a reliability coefficient was not possible for this sample size distribution without risking an unstable estimate.

#### *5.5 Procedures*

The data from the survey platform were exported to IBM SPSS and checked for accuracy before analysis. Categorical variables were converted to numeric values with value labels for interpretation. The tool-diversity index was created by doing a text search of the multi-select technology field for five keyword categories and adding the binary indicators (range 0 to 5). The testing for RQ1 involved a crosstabulation of pedagogical approach by challenge type, followed by a multinomial logistic regression with challenge type as the outcome variable and pedagogical approach as the only predictor. One-way ANOVAs were employed for RQ2 to determine whether there were differences in confidence and tool diversity between benefit-type groups, with an ordinal logistic regression (PLUM) used to determine whether tool diversity predicted confidence, and the test of parallel lines was used to test the proportional-odds assumption. In RQ3, both perceived technology increase and actual frequency of use were simultaneously entered as predictors of challenge type in one multinomial logistic regression model to estimate the effects of each predictor while controlling for the other. Independent-samples t-tests were used to compare the three Vision 2030 items by geographic background (equal- or unequal-variances estimates, as determined by the Levene test); one-way ANOVAs with Tukey HSD post hoc tests compared the same items across the three groups of respondents with different geographic backgrounds. The open-ended items were read in full for all respondents who answered them and were coded thematically based on a set of categories that were inductively derived for RQ5, and from which multiple codes were possible; a residual "non-substantive/no answer" category was retained instead of forcing it into a substantive theme, and theme frequencies were cross-tabulated by rural/urban background.

### **6. Results**

#### *6.1 Descriptive Overview*

The tool-diversity index was broadly normally distributed, with 27 students (11.6%) reporting all five technology types, 13.3% reporting four, 17.6% reporting three, 27.0% reporting two, and 30.0% reporting one technology type (no technologies in use);  $n = 1$ .

#### *6.2 RQ1: Pedagogical Approach and Challenge Type*

A cross-tabulation was performed between pedagogical approach (traditional, blended, highly technology-

based) and the four challenge categories (technical issues, limited prior experience, lack of motivation, difficulty following online classes), for the 228 respondents who provided valid data on both variables (97.9% of the sample). Descriptively, there is a mid-range in technical issues and limited prior experience complaints from students in traditional institutions and a similar mid-range for students in blended institutions, while students in highly technology-based institutions more often reported limited prior experience (51.2%) than technical issues (27.9%), as shown in Table 1.

**Table 1**

*Cross-Tabulation of Pedagogical Approach and Challenge Type*

| Pedagogical approach    | Technical issues | Limited prior experience | Lack of motivation | Difficulty following online | Total (n) |
|-------------------------|------------------|--------------------------|--------------------|-----------------------------|-----------|
| Traditional             | 6 (35.3%)        | 6 (35.3%)                | 3 (17.6%)          | 2 (11.8%)                   | 17        |
| Blended                 | 61 (36.3%)       | 66 (39.3%)               | 21 (12.5%)         | 20 (11.9%)                  | 168       |
| Highly technology-based | 12 (27.9%)       | 22 (51.2%)               | 4 (9.3%)           | 5 (11.6%)                   | 43        |
| Total                   | 79 (34.6%)       | 94 (41.2%)               | 28 (12.3%)         | 27 (11.8%)                  | 228       |

There was no significant association between pedagogical approach and challenge type, using a Pearson chi-square test:  $\chi^2(6, N = 228) = 2.75, p = .840$ , Cramér's  $V = .078$ ; or a linear-by-linear association:  $\chi^2(1) = 0.008, p = .929$ . The effect size is small for both, but two cells (16.7%) had expected frequencies below 5, so the results should be interpreted with caution. A Monte Carlo-based exact test (100,000 resamples) confirmed that this result was not distorted by the low expected cell counts ( $p = .849$ ). A multinomial logistic regression with challenge type (reference: technical issues) as the outcome and pedagogical approach as the only factor was used to verify this null result, and confirmed that it explained little variance (Nagelkerke  $R^2 = .011$ , McFadden  $R^2 = .004$ ) and was not relevant to the odds reporting limited prior experience ( $B = 0.38$ , Wald = 1.51,  $p = .219$ ), lack of motivation ( $B = -0.17$ , Wald = 0.14,  $p = .710$ ) or difficulty following online classes ( $B = 0.14$ , Wald = 0.10,  $p = .749$ ) as predictors compared to technical issues. So, the following research question is not supported: the institutional pedagogical approach alone cannot predict the type of adaptation challenge that Saudi EFL students report.

### 6.3 RQ2: Tool Diversity, Benefit Type, and Confidence

The one-way ANOVA testing for differences in confidence in using digital tools among the four benefit-type groups was significant,  $F(3, 228) = 5.64, p = .001$ . The highest mean confidence rating ( $M = 3.46, SD = 0.70$ ) was for “easier access to materials,” followed by “more interaction and feedback” ( $M = 3.27, SD = 0.74$ ), “flexible timing” ( $M = 3.03, SD = 0.93$ ), and “independent learning” ( $M = 2.93, SD = 0.75$ ).

A parallel one-way ANOVA for the same four benefit-type groups did not show significant differences in the tool-diversity index,  $F(3, 228) = 0.75, p = .526$ , with the means all close to each other (between 2.27 and 2.59).

When tested directly using a PLUM ordinal logistic regression, however, tool diversity was slightly, but significantly, positively associated with confidence (estimate = 0.185, Wald = 3.96,  $p = .047$ , 95% CI [0.003, 0.367]); the final model significantly outperformed the intercept-only model,  $\chi^2(1) = 3.95, p = .047$  (Nagelkerke  $R^2 = .019$ ).

The test of parallel lines was non-significant,  $\chi^2(2) = 2.10, p = .350$ , consistent with the proportional-odds assumption underlying this model. When combined, RQ2 is partially supported: The diversity of the tools students reported does not correlate with the type of benefit they mention, but is a small, significant predictor of confidence in using digital tools. Given that this is the only statistically significant quantitative association observed across the study's four research questions, and no correction for multiple comparisons was applied to the full set of tests, this result should be interpreted with caution and treated as exploratory rather than confirmatory.

### 6.3 RQ3: Perceived versus Actual Technology Change as Predictors of Challenge Type

Perceived increase in technology use relative to prior education and actual frequency of technology use were simultaneously entered into a multinomial logistic regression as predictors of challenge type (reference category: technical issues). The overall model accounted for a relatively small amount of variance (McFadden  $R^2 = .015$ , Nagelkerke  $R^2 = .041$ ). While neither predictor achieved statistical significance for any challenge contrast, this was less notable than in RQ1, as shown in Table 2.

**Table 2**

*Multinomial Logistic Regression Predicting Challenge Type from Perceived and Actual Technology Use*

| Challenge contrast (ref. = Technical issues) | Predictor                                     | B      | Wald  | df | p    |
|----------------------------------------------|-----------------------------------------------|--------|-------|----|------|
| Limited prior experience                     | Intercept                                     | -0.543 | 0.313 | 1  | .576 |
| Limited prior experience                     | Perceived technology increase (Tech-Change_n) | 0.318  | 1.965 | 1  | .161 |
| Limited prior experience                     | Actual frequency of use (UseFreq_n)           | -0.119 | 0.326 | 1  | .568 |
| Lack of motivation                           | Intercept                                     | 0.644  | 0.289 | 1  | .591 |
| Lack of motivation                           | Perceived technology increase (Tech-Change_n) | -0.286 | 1.051 | 1  | .305 |
| Lack of motivation                           | Actual frequency of use (UseFreq_n)           | -0.217 | 0.588 | 1  | .443 |
| Difficulty following online classes          | Intercept                                     | 0.815  | 0.463 | 1  | .496 |
| Difficulty following online classes          | Perceived technology increase (Tech-Change_n) | -0.252 | 0.783 | 1  | .376 |
| Difficulty following online classes          | Actual frequency of use (UseFreq_n)           | -0.315 | 1.268 | 1  | .260 |

The odds associated with perceived technology increase across each of the three contrasts were not significantly different from the odds associated with technical issues for limited prior experience ( $B = 0.32$ ,  $Wald = 1.97$ ,  $p = .161$ ), lack of motivation ( $B = -0.29$ ,  $Wald = 1.05$ ,  $p = .305$ ), or difficulty following online classes ( $B = -0.25$ ,  $Wald = 0.78$ ,  $p = .376$ ). The same held for actual frequency of use: limited prior experience ( $B = -0.12$ ,  $Wald = 0.33$ ,  $p = .568$ ), lack of motivation ( $B = -0.22$ ,  $Wald = 0.59$ ,  $p = .443$ ), and difficulty following online classes ( $B = -0.32$ ,  $Wald = 1.27$ ,  $p = .260$ ). RQ3 is thus not supported in this sample: neither the perceived relative increase in technology nor the actual frequency of use, nor their combination, significantly predicts the student's report of an adaptation challenge.

### 6.4 RQ4: Vision 2030 Perceptions by Geographic Background and Prior Environment

Independent-samples t-tests were used to compare urban-background ( $n = 195$ ) and rural-background ( $n = 38$ ) respondents on the three Vision 2030 items: modern learning environments, reaching global English standards, and rural students' need for support. The three comparisons were not statistically significant. For "Vision 2030 created modern learning environments," rural students scored numerically higher ( $M = 4.05$ ,  $SD = 0.90$ ) than urban students ( $M = 3.84$ ,  $SD = 1.15$ ), but the difference was not significant,  $t(231) = -1.10$ ,  $p = .274$ , Cohen's  $d = -0.20$ . For "technology helps students reach global English standards," the pattern was similar (rural  $M = 3.95$ ,  $SD = 0.90$ ; urban  $M = 3.73$ ,  $SD = 1.14$ ),  $t(231) = -1.12$ ,  $p = .265$ ,  $d = -0.20$ . For "rural students need more support to adapt," urban and rural means were nearly identical (urban  $M = 3.74$ ,  $SD = 1.20$ ; rural  $M = 3.76$ ,  $SD = 1.20$ ),  $t(231) = -0.09$ ,  $p = .927$ ,  $d = -0.02$ . In all cases, the effect sizes were small, and the confidence intervals for the mean differences contained zero.

The same three items were compared across the three previous environmental groups (mostly traditional, some technology used, mostly digital) using one-way ANOVAs, and none were significant.

Modern learning environments,  $F(2, 230) = 0.46$ ,  $p = .629$ ; reaching global English standards,  $F(2, 230) = 0.15$ ,  $p = .858$ ; rural students need more support,  $F(2, 230) = 0.42$ ,  $p = .660$ . pairwise comparisons within the Vision 2030 items using Tukey HSD post hoc comparisons and the homogeneous-subsets tables revealed no meaningful group separation with all three prior-environment groups in a single subset for all Vision 2030 items (all  $p > .60$ ). The answers for RQ4 are therefore not as clear as those for the other RQs, because, in this sample, students' perceptions of the impact of Vision 2030 did not vary significantly across geographic background

or across the type of English-learning environment before university, and the direction of the effect — rural students scoring higher than urban students — runs opposite to the assumption that students in rural locations perceive the digital-transformation agenda less favourably.

### *6.5 RQ5: Qualitative Themes and Alignment with the Rural-Support Finding*

The two open-ended items (38 rural-background, 194 urban-background) were all fully read and thematically coded. The most common substantive themes were a general recognition that things had changed (without specifying how) (35%), using more technology or digital tools (18%), change in teaching style or approach by the instructor, which often came in the form of a shift from memorization to understanding (16%), increased independence and self-directed responsibility (5%); 11% of responses were non-substantive (e.g., single words, punctuation, or “I don’t know”); 8% reported little or no difference in learning experience in school versus college. The most common responses for “what can universities do to help rural students adapt” included (notably) no answer or “I don’t know” (20%), followed by general, non-specific appeals for support or attention (10%), structured training or courses in digital and language skills (9%), simplifying the content and pacing of instruction more slowly (7%), and providing devices or technical equipment (6%); transportation and commuting barriers were cited by 3% of respondents, as were online or distance-learning options (3%) and infrastructure improvements like internet connections (3%).

The qualitative patterns in this item support and complement the quantitative finding in item 15c regarding rural support. The framing of the original research question implies that the majority might be those who disagreed with the need for more support for rural students to adapt; however, this was not the case, as 61.4% of the entire sample selected Agree or Strongly Agree, 27.0% were Neutral, and 11.6% selected Disagree or Strongly Disagree, with a non-significant t-test reported for this item between rural-background and non-rural-background samples (RQ4). The open-ended data provide further insights into the practicality of that majority-but-qualified agreement: hardware was not the first answer that came to mind, with students most often citing structured training and gradual pacing; a significant fifth of respondents, both rural and urban, did not or could not provide a specific suggestion. The quantitative picture, in which rural background predicted virtually none of the outcomes measured, reflected the qualitative picture of a range of relatively small, scattered supports, closing the gap between broad endorsement of the principle and any one concrete mechanism.

## **7. Discussion**

The trend across all four quantitative research questions is very consistent: institution-level technology variables, pedagogical approach, the diversity of available technologies as a predictor of benefit type, perceived-versus-actual technology change, and geographic/prior-environment background were, with one partial exception, unrelated to the outcomes measured. The slight but statistically significant association between tool diversity and confidence (RQ2) accounted for less than 2% of the variance in confidence. Given that this is the only significant quantitative association observed across the study, and that no correction for multiple comparisons was applied, we treat this as an exploratory signal rather than a confirmed effect, warranting replication in future work. Additionally, because these variables were measured with single categorical items rather than validated multi-item scales, the null findings for RQ1, RQ3, and RQ4 may reflect either no true association or measurement error. This aligns with Alqahtani et al. (2022), who found that perceived ease of use and usefulness, rather than the provision of technology, influenced Saudi students’ attitudes towards e-learning.

The lack of a result for RQ1 is also consistent with the specific challenges reported in previous Saudi EFL studies. Technical issues and not knowing how to use digital tools are both common complaints, irrespective of the overall level of “advanced” design of the course, as both Bin Dahmash (2020) and Al-Samiri (2021) described, whereas the present results extend this finding to demonstrate formally that the distribution of these challenge types does not change significantly between the three institutions. This could indicate that students entering into a more technologically advanced environment may feel under-prepared, although that is not the case here, as it is not significant (Frei-Landau et al., 2022).

The RQ3 result is arguably the most theoretically interesting null finding among the results of the study, as it aimed to test the hypothesis that subjective, perceived technology change matters more than objective, measured frequency of use, which is a question truly not addressed in the Saudi EFL literature. These two factors did not significantly predict challenge type when compared with each other or when both were considered

together, as measured here. This indicates that for this population, the reported type of challenge faced may be more influenced by stable individual differences (confidence, prior digital literacy, personality) than by either the level of perceived change in technology or the level of current technology use, a conclusion that is indirectly supported by the significant but rather weak relationship between tool-diversity and confidence in RQ2. This could only be tested directly using a validated confidence or digital self-efficacy scale, in addition to these institutional factors.

The combined RQ4 and RQ5 findings call into question the assumption, which appears to be supported at the national infrastructure and teacher perspectives level (Al-Khresheh et al., 2025; Alfalah et al., 2025; Saad & Fahim, 2021), that the digital-transformation agenda is implemented differently in rural areas compared to urban areas in Saudi Arabia. The rural-background students did not score significantly differently from the urban-background students on any item on Vision 2030 — though, as noted above, the study was underpowered to detect anything smaller than a medium effect — and, in fact, numerically higher in some areas relating to the success of Vision 2030 in developing modern learning environments and achieving international standards on English in schools. This result is contrary to the belief of Digital Divide Theory, which would suggest that the digital disadvantage of the rural population is expressed in the geographical location of students, rather than their digital capital (Alfalah et al., 2025); however, this is not necessarily inconsistent with Digital Divide Theory if selection effects are taken into account: students who have successfully enrolled in and persisted in a university EFL program in Saudi Arabia may be a self-selected group whose digital capital is more like that of their urban counterparts than the overall rural population, as explored by Zhao et al. (2022). The qualitative data corroborate this interpretation: when students' open-ended responses were analyzed, there was no systematic difference between the negative or even more technology-negative responses from rural-background students and those from urban students, and several of the most specific and well-formulated suggestions for how to help rural students, such as sending more qualified teachers to rural schools and providing devices to “balance education between rural and urban students”, were made by students when they were describing the general problem rather than describing their own personal acute disadvantage.

When examined together, these outcomes provide a more complex picture than either the positive Vision 2030 narrative (Banafi, 2025; Alqahtani & Albidewi, 2022) or the negative digital-divide narrative (Al-Khresheh et al., 2025; Alfalah et al., 2025) would suggest. Students' endorsements of the principle that rural students need more support are generally positive (61.4% agreement), and the students' experiences with the technology used in their schools (as reflected in generally favorable Likert means across the sample) do not seem to be explained by the four institutional technology variables tested here: pedagogical approach, tool diversity, perceived versus actual change, and geographic background. This suggests individual-level and, potentially, classroom-level factors (instructor quality, personal digital self-efficacy, family and social supports that have been highlighted by Zhao et al., 2022) as more viable targets for future institutional intervention than wholesale interventions on technology provision or assuming rural students are categorically less well-supported than urban students upon their arrival at school.

These results also contradict the literature on institutional implementation reviewed above. Aljaber (2018) predicted that, at the policy analysis level, institutional reliability and consistency of implementation would matter more than the course label itself, and this study supports this: “blended” and “highly technology-based” were not course labels that predicted the problems students faced.

## 8. Conclusion

The study aimed to examine the possible relationship between an institution's technology profile and the adaptation challenges that Saudi EFL undergraduate students perceive, particularly among rural students. The findings imply that the Saudi EFL digital-transformation agenda could be better served by focusing on confidence-building at the personal level and instructional quality at the classroom level, rather than continued growth in institutional technology intensity or diversity alone, at least in the context of students already enrolled in university programs. A larger, more balanced sample of schools across a rural–urban continuum would provide sufficient power to detect rural–urban differences, which were small in this study. The instruments to be reported in the years to come should include validated multi-item scales for confidence, digital self-efficacy, and perceived pedagogical intensity, so that reliability coefficients can be reported.

### *8.1 Limitations*

The following limitations should be considered when interpreting these conclusions. First, the sample was convenience-sampled from one institution (or a few affiliated campuses), limiting its generalizability to EFL Higher Education in Saudi Arabia. Second, the rural subsample ( $n = 38$ ) was relatively small compared to the urban subsample ( $n = 195$ ), which limits the power in the comparisons of RQ4 and results in wider confidence intervals for the rural group estimates; thus, a non-significant result does not preclude a true but small rural–urban difference that this study was not powerful enough to detect. A post-hoc power analysis indicated that, given the achieved sample sizes ( $n = 195$  urban,  $n = 38$  rural), the study had approximately 80% power to detect only a medium effect (Cohen’s  $d \geq 0.50$ ) at  $\alpha = .05$ . Power to detect the observed effect sizes ( $d = -0.20$  for two of the three comparisons) was only about 20%. The null results for RQ4 should therefore be interpreted as inconclusive with respect to small-to-moderate rural-urban differences, rather than as evidence that no such differences exist. Thirdly, it was noted that several of the constructs used (challenge type, benefit type, confidence, pedagogical approach) were measured by a single categorical item; therefore, no internal consistency reliability coefficient could be calculated for these items, and single-item measures are inherently noisier than composite measures. Fourth, the cross-sectional design doesn’t allow for causal inference: students who are already more confident might be more willing to seek out, or more aware of, a wider range of technology, rather than technology exposure itself causing increased confidence. Fifth, the qualitative coding in RQ5 was done by a single coder, based on a systematic, keyword-assisted content analysis, rather than an independently double-coded, saturation-driven grounded theory analysis, and less than one-fifth of the responses to each open-ended item were long enough and detailed enough to code substantively, which reduces the representativeness of the qualitative theme frequencies to the actual range of student responses.

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**Conflicts of Interest**

The author declares no conflict of interest.

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**Public Interest Statement**

Saudi Arabia's Vision 2030 has driven rapid technology adoption across universities, but little evidence exists on whether this eases or worsens the difficulties English-language students face, or whether rural students are being left behind, as often assumed. This study surveyed 233 Saudi EFL undergraduates and found that institutional technology profile explains little of what challenges students report, and that rural and urban students perceive Vision 2030's reforms similarly. The findings suggest that policy attention may be better directed toward building student confidence and instructional quality than toward further technology provision alone.

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