JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

TEACHERS' PERCEPTIONS OF PERSONALIZED LEARNING AND ADAPTIVE EDUCATIONAL TECHNOLOGIES IN GOVERNMENT COLLEGES OF TEHSIL FAISALABAD, PAKISTAN

Sheeza[1], Gulfam Hasan[2], Muhammad Rafay Muzamil[3], Rana Muhammad Amir[4], Rao Sabir Sattar[*5]

[1,2,3,4,*5]*Institute of Agricultural Extension, Education and Rural Development, University of Agriculture, Faisalabad, Pakistan*

[*5]sabirsattar@uaf.edu.pk

DOI: https://doi.org/10.5281/zenodo.24079939

Keywords
Personalized learning; adaptive educational technology; teacher perceptions; digital learning; professional development; government colleges; Pakistan.

Article History
Received: 05 August 2026
Accepted: 19 October 2026
Published: 04 November 2026

Copyright @Author
Corresponding Author: *
Rao Sabir Sattar

Abstract
Personalized learning and adaptive educational technologies are increasingly promoted as ways of responding to learners' diverse needs, prior knowledge and pace, but their implementation depends largely on teachers' understanding, preparedness and institutional support. This study examined teachers' awareness of personalized learning, their perceptions of its influence on student engagement and self-efficacy, the challenges they associate with implementation, and their views on adaptive platforms for identifying and supporting at-risk students. A cross-sectional descriptive survey was conducted in three of the 26 government colleges of Tehsil Faisalabad, Pakistan, selected by convenience sampling. A sample of 106 teachers completed a structured questionnaire. Data were analyzed with descriptive statistics in SPSS. Agreement was high across most domains: 34 of 52 statements had means of 4.00 or above. Teachers strongly endorsed that personalized learning increases engagement (M = 4.41, SD = 0.70), that setting personal goals supports students' sense of control (M = 4.45), and that adaptive platforms can provide multiple explanations after an unsuccessful attempt (M = 4.43). The most strongly endorsed challenges were additional preparation (M = 4.46), time demands (M = 4.38) and workload from managing multiple learning paths (M = 4.31).Teachers perceived personalized learning and adaptive technologies as pedagogically promising but resource-intensive. Teacher training, workload management, technological infrastructure and data-protection safeguards appear to be prerequisites for implementation.

1. INTRODUCTION
The integration of digital technologies into education has increased interest in personalized learning and adaptive educational technologies as ways of addressing learners' diverse needs, prior knowledge, learning pace and abilities. In contrast to conventional teacher-centered instruction, personalized learning emphasizes learner-centered

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal
ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

experiences, flexible instructional pathways and targeted feedback, while adaptive technologies use information about learners' progress to adjust the instructional support they receive. When appropriately integrated into teaching, these approaches have been associated with greater student engagement, learner autonomy and academic performance (Lucas et al., 2020; Carmela et al., 2021). The concept is nevertheless contested: personalized learning is widely endorsed as a strategy for improving engagement and attainment, yet its conceptual coherence and its effects on different groups of learners have been questioned (Prain et al., 2013), and systematic reviews note that studies differ in who personalizes learning, what is personalized, and for what purpose (Bernacki et al., 2021).

Earlier studies point to both the promise and the limits of flexible and technology-supported instruction in higher education. Sewagegn and Diale (2019) examined modular and block teaching in Ethiopian higher education institutions and reported that concentrating on one subject at a time helped students focus, but that practical learning and the implementation of active learning were constrained by limited instructional time. Banditvilai (2016) investigated blended instruction in language learning and reported gains in vocabulary among students receiving technology-supported instruction compared with those taught by traditional methods, and Du Plooy et al. (2024) examined technology-supported approaches in tertiary education in relation to student performance, achievement and motivation. Taken together, these studies suggest that flexible, technology-supported instruction can contribute to learning, but that its effectiveness depends on context and on how it is implemented.

Personalized learning also rests on learner autonomy, active participation and adaptation of instruction to individual requirements. Nardo (2017) described instructional design approaches intended to promote autonomous learning, and Mercer & Howe (2012) emphasized the importance of helping students organize, monitor and regulate their own learning. Mandinach, (2012) discussed how technology-supported approaches can help teachers select appropriate teaching methods, monitor student performance and identify remedial measures for learners who are struggling. These perspectives underline the importance of understanding students' learning needs and providing appropriate instructional support.

Teachers remain central to implementation. Their role extends beyond delivering content to facilitating learning, giving feedback, monitoring progress and creating supportive environments in which students participate actively. Teachers' pedagogical knowledge, beliefs, attitudes and competencies shape their instructional practice (Vieluf & Klieme, 2023), and technology-supported learning is associated with opportunities for independent study, flexible learning and assessment of acquired knowledge (Mirari, 2022). The integration of educational technology therefore requires not only access to digital resources but also teachers' capacity and willingness to use them in ways that support diverse learners.

Implementation may nevertheless be hindered by limited teacher preparedness, instructional planning demands, technological resources and institutional support. Adaptive technologies that identify students at risk of academic difficulty, for example, are useful only if learning progress is monitored and timely instructional help follows. These considerations make it important to examine teachers' awareness of personalized learning and their perceptions of its practical application. Evidence on teachers' perceptions of personalized learning plans and adaptive technologies in government colleges in Pakistan remains limited. The present study addresses this gap in Tehsil Faisalabad, Punjab.

The study had four objectives:

(1) to assess teachers' awareness of personalized learning and their familiarity with its implementation;

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

(1) to examine teachers' perceptions of the benefits and challenges of personalized learning plans;
(2) to explore teachers' perceptions of the influence of personalized learning plans on student engagement and self-efficacy; and
(3) to describe teachers' views on the role of adaptive platforms in identifying and supporting at-risk students.

2. Methodology

A cross-sectional descriptive survey design was used to examine teachers' perceptions of the effectiveness of personalized learning plans (PLPs) and adaptive educational technologies in supporting student learning.

The study was conducted in Tehsil Faisalabad, Punjab, Pakistan. Three colleges were selected by convenience sampling. The teaching staff of the three colleges (N = 145) formed the target population. A sample size of 106 was obtained from an online sample-size calculator at a 95% confidence level and 5% margin of error; the same figure follows from the simplified formula $n = N / (1 + Ne^2)$ (Yamane, 1967). Data were collected with a structured, pretested questionnaire developed in line with the study objectives. It comprised a section on demographic and professional characteristics and 52 statements grouped into nine domains: awareness of personalized learning (6 items), familiarity with implementation (4), perceived benefits (7), perceived challenges (13), perceived influence on student engagement (5), perceived influence on student self-efficacy (5), and three domains on adaptive platforms—identification and early warning (4), targeted support and scaffolding (4) and teacher intervention (4). Responses were recorded on a five-point Likert-type scale from 1 = strongly disagree to 5 = strongly agree. Respondents were selected conveniently and they were informed of the purpose and objectives of the study and given instructions on how to complete the questionnaire. Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Frequencies and percentages were used to describe respondents' characteristics, and means and standard deviations to summarize responses to each statement.

3. Results

The largest age group was 30–35 years (37.7%), followed by 25–29 and 36–40 years (24.5% each); 13.2% were aged 41–50 years and none was older than 50. Half of the respondents (50.0%) held a graduate-level qualification, 37.7% a postgraduate qualification and 12.3% an undergraduate qualification. B.Ed. was the most common professional qualification (37.7%), followed by BS Ed. (25.5%); M.Ed., CT/PTC diploma and other qualifications accounted for 12.3% each. Equal shares (37.7%) had 6–10 years and more than 10 years of teaching experience, and 24.5% had five years or less. Most respondents held regular appointments (62.3%), compared with contract (25.5%) and ad hoc (12.3%) appointments. The sample thus includes teachers with varied qualifications and experience; because colleges were selected by convenience as shown in Fig. 1.

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

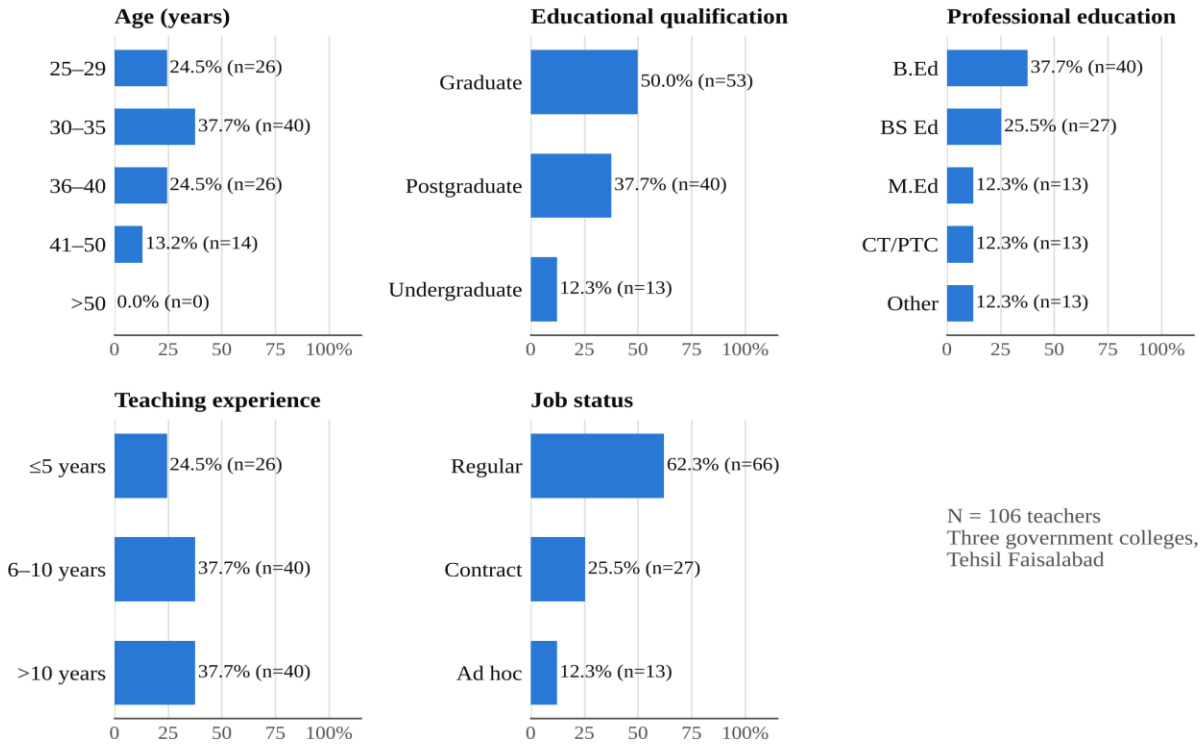

Figure 1. Demographic and professional profile of respondents (*N* = 106).

3.2 Overview of responses

Teachers' responses were generally favorable. Of the 52 statements, 34 had means of 4.00 or above, and only the two negatively worded statements fell below 3.00. Mean-of-item-means for the nine domains ranged from 3.92 (perceived challenges) to 4.22 (adaptive platforms: scaffolding) (Table 2; Figure 2). Standard deviations ranged from 0.69 to 1.09 and were inversely related to the means across statements ($r = -0.92$): agreement was most uniform for the most strongly endorsed statements and more dispersed for those with lower means.

Table 2. Summary of domain scores

Domain	Items	Mean of item means	Highest-rated statement (*M*)
Awareness of personalized learning	5	4.10	Personalized learning is a student-centered approach (4.36)
Familiarity with implementation	4	4.11	Teacher as facilitator or coach (4.33)
Perceived benefits	6	4.13	Increases student engagement (4.41)
Perceived challenges	13	3.92	Requires special preparation efforts (4.46)
Perceived influence on student engagement	5	4.18	Connection to personal interests (4.42)

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

Domain	Items	Mean of item means	Highest-rated statement (*M*)
Perceived influence on student self-efficacy	5	4.19	Own goal-setting fosters control (4.45)
Adaptive platforms: early warning	4	4.18	Faster gap identification than paper tests (4.39)
Adaptive platforms: scaffolding	4	4.22	Multiple explanations after failure (4.43)
Adaptive platforms: teacher intervention	4	4.16	Private work reduces stigma (4.38)

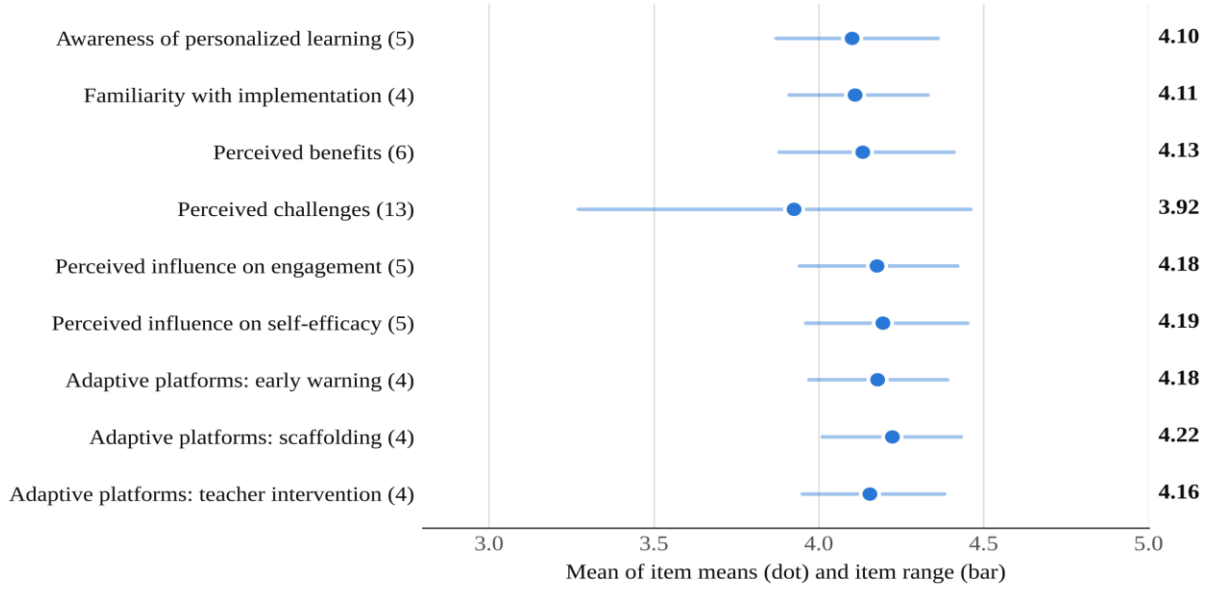

Figure 2. Domain scores (mean of item means, dot) and the range of item means within each domain (bar).

3.3 Awareness of personalized learning and familiarity with implementation

Respondents showed strong conceptual awareness (Table 3). The highest mean was for the view that personalized learning is student-centered (M = 4.36, *SD* = 0.72), followed by the view that students should have a voice in setting learning goals (M = 4.21, *SD* = 0.79). The statement that personalized learning means working alone on a computer all day had a mean of 2.74 (*SD* = 1.01), indicating that respondents did not generally endorse this characterization. Familiarity with implementation was also high: the role of the teacher as a facilitator or coach had a mean of 4.33 (*SD* = 0.74), and the usefulness of digital tools for supporting personalized learning paths a mean of 4.18 (*SD* = 0.81).

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

Table 3. Teachers' awareness of personalized learning and familiarity with implementation (*N* = 106)

Rank	Statement	*M*	*SD*	Agreement level
Awareness of personalized learning				
1	Personalized learning is a student-centered approach	4.36	0.72	Strongly agree
2	Personalized learning requires students to have a voice in their learning goals	4.21	0.79	Strongly agree
3	Students move to the next topic after demonstrating mastery, regardless of the time required	4.08	0.83	Agree
4	There is a difference between individualized instruction and personalized learning	3.98	0.86	Agree
5	Personalized learning means tailoring education to individual needs	3.87	0.88	Agree
6	Personalized learning means a student works alone on a computer all day †	2.74	1.01	Undecided
Familiarity with implementation				
1	The teacher acts as a facilitator or coach rather than the primary source of all information	4.33	0.74	Strongly agree
2	Digital tools can support a personalized learning path	4.18	0.81	Agree
3	Classroom layouts can be changed to support different learning styles	4.02	0.85	Agree
4	Learner profiles can track student interests and strengths	3.91	0.89	Agree

3.4 Perceived benefits and challenges

The most strongly endorsed benefits were that personalized learning can increase student engagement (M = 4.41, SD = 0.70) and that it tailors instruction to learners' profiles, interests and needs (M = 4.29, SD = 0.75). Data-based progress monitoring and learner voice were also viewed positively. The low mean for adhering to a rigid, one-size-fits-all timeline (M = 2.69, SD = 1.04) is consistent with a preference for flexibility over uniform pacing (Table 4; Figure 3). The principal challenges were the additional preparation required (M = 4.46, SD = 0.69), time demands (M = 4.38, SD = 0.73) and the workload of managing multiple learning paths (M = 4.31, SD = 0.76). Attention to individual differences, the need for a structured classroom and data-privacy concerns also received high means (4.03–4.22). Cultural mismatch (M = 3.84), context-related problems (M = 3.76) and student motivation (M = 3.68) received more moderate agreement, and risk of mismanagement had the lowest mean in the domain (M = 3.27, SD = 1.09; undecided). Respondents therefore viewed personalization as promising but resource-intensive. These results describe perceived benefits; the survey cannot show that personalized learning caused improvements in student outcomes.

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

Table 4. Teachers' perceptions of the benefits and challenges of personalized learning (*N* = 106)

Rank	Statement	*M*	*SD*	Agreement level
Perceived benefits				
1	Personalized learning can significantly increase student engagement	4.41	0.70	Strongly agree
2	Instruction is tailored to student profiles, interests, and needs	4.29	0.75	Strongly agree
3	Teachers use data to monitor progress	4.17	0.80	Agree
4	Learners have a voice in their learning	4.09	0.82	Agree
5	Personalized learning aims to close achievement gaps for diverse learners	3.96	0.87	Agree
6	Students move through the curriculum at their own speed	3.88	0.90	Agree
7	Adhering to a rigid, one-size-fits-all timeline †	2.69	1.04	Undecided
Perceived challenges				
1	Requires special preparation efforts	4.46	0.69	Strongly agree
2	Requires a lot of time	4.38	0.73	Strongly agree
3	Workload challenges when managing multiple learning paths	4.31	0.76	Strongly agree
4	Requires special attention to individual differences	4.22	0.79	Strongly agree
5	Requires a structured classroom	4.11	0.82	Agree
6	Data privacy concerns when tracking individual learning data	4.03	0.86	Agree
7	Receiving feedback specific to individual progress	3.95	0.88	Agree
8	Cultural mismatch	3.84	0.91	Agree
9	Context-related problems	3.76	0.94	Agree
10	Students may sometimes be poorly motivated	3.68	0.97	Agree
11	Lack of experience may reduce student participation	3.59	1.00	Agree
12	"Just-in-time" instruction to fill specific knowledge gaps	3.42	1.05	Agree
13	Risk of mismanagement	3.27	1.09	Undecided

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

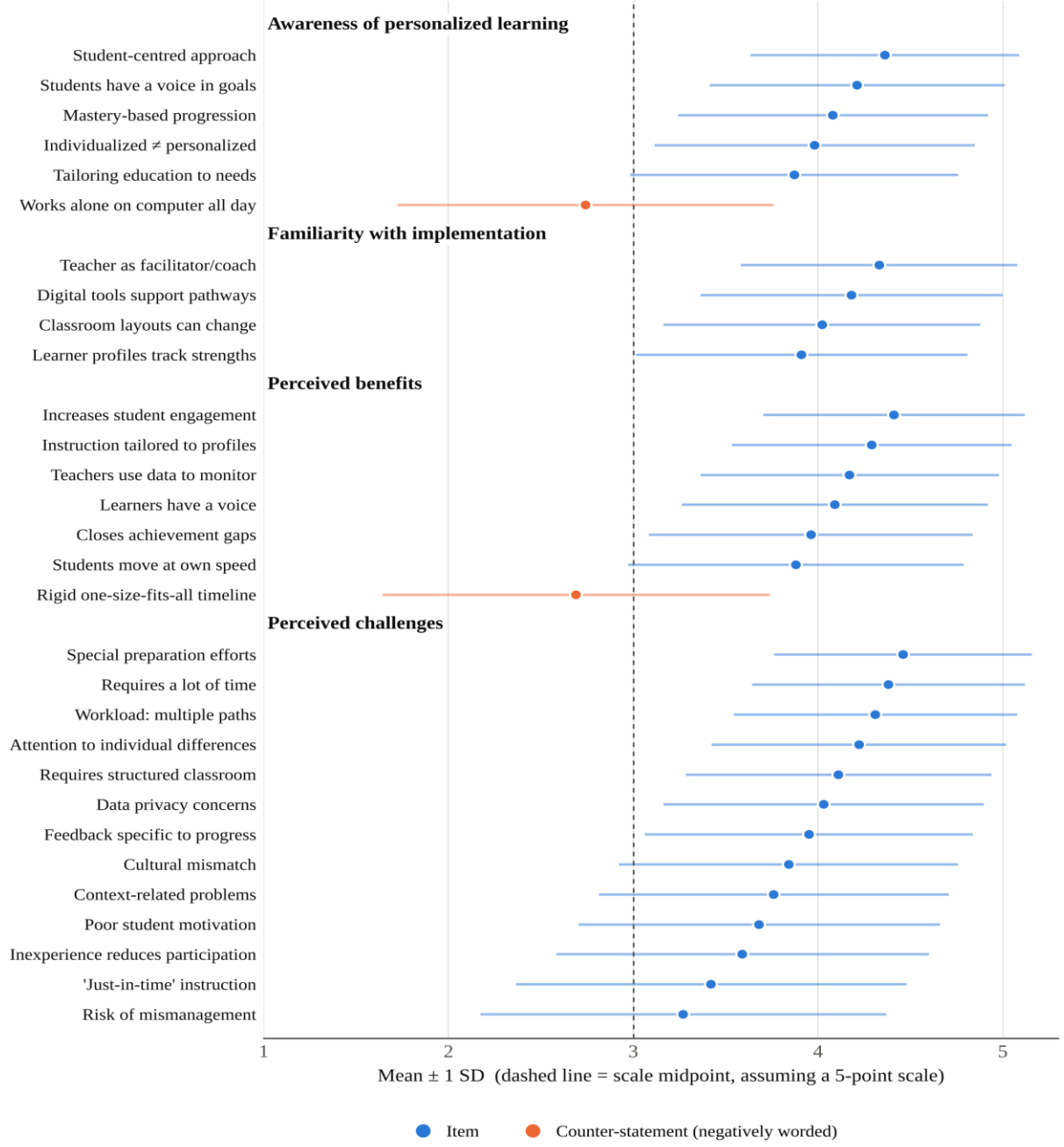

Figure 3. Item-level results for awareness, familiarity, benefits and challenges (mean ± 1 *SD*). Orange marks negatively worded statements.

3.5 Perceived influence on student engagement and self-efficacy

Teachers perceived positive links between personalized learning plans and student engagement (Table 5; Figure 4). Connecting topics with students' personal interests had a mean of 4.42 (*SD* = 0.71), and greater excitement about attending class a mean of 4.29 (*SD* = 0.75). Choice

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

in learning and persistence with difficult tasks were also rated positively (*M* = 4.17 and 4.06). For self-efficacy, students setting their own learning goals had the highest mean (*M* = 4.45, *SD* = 0.69), followed by confidence in mastering difficult concepts (*M* = 4.31, *SD* = 0.74). Because these data come from teachers' questionnaire responses, they are perceived influences rather than measured changes in engagement or self-efficacy.

Table 5. Teachers' perceptions of the influence of personalized learning plans on student engagement and self-efficacy (*N* = 106)

Rank	Statement	*M*	*SD*	Agreement level
Perceived influence on student engagement				
1	Students feel more connected to topics related to their personal interests	4.42	0.71	Strongly agree
2	A personalized learning plan makes students more excited to attend class	4.29	0.75	Strongly agree
3	Students are more likely to participate in discussions when they have learning choices	4.17	0.80	Agree
4	Students are motivated to complete difficult tasks when these are part of their personal learning path	4.06	0.84	Agree
5	Students remain focused on schoolwork for longer periods	3.94	0.88	Agree
Perceived influence on student self-efficacy				
1	Setting their own learning goals helps students feel in control of academic success	4.45	0.69	Strongly agree
2	Students feel confident that they can master a difficult concept	4.31	0.74	Strongly agree
3	Students can achieve grades by using a plan tailored to their strengths	4.18	0.79	Agree
4	Students feel more capable of working independently than in a traditional classroom	4.07	0.83	Agree
5	Teachers can identify alternative ways to help students solve academic challenges	3.96	0.87	Agree

3.6 Adaptive platforms and support for at-risk students

Respondents viewed adaptive platforms as useful for identifying learning gaps and supporting targeted intervention (Table 6). Faster identification of learning gaps than paper-and-pencil assessment had a mean of 4.39 (*SD* = 0.72), and real-time data enabling intervention within 24–48 hours a mean of 4.24 (*SD* = 0.77). For targeted support, offering multiple explanations after an unsuccessful attempt received the highest mean among the adaptive-platform statements (*M* = 4.43, *SD* = 0.70), followed by dynamic adjustment of content difficulty (*M* = 4.29, *SD* = 0.74). Respondents also agreed that private practice of foundational skills reduces stigma (*M* =

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

4.38, *SD* = 0.73) and that platform data can help allocate one-to-one and small-group teacher time (M = 4.22 and 4.07). The lowest means concerned the predictive use of data (M = 3.97) and the confidence it gives teachers in interventions (M = 3.95). The predictive accuracy and effectiveness of adaptive platforms were not tested; doing so would require platform records, student outcome data or an evaluation design.

Table 6. Teachers' perceptions of adaptive platforms for identifying and supporting at-risk students (N = 106)

Rank	Statement	*M*	*SD*	Agreement level
Identification and early warning				
1	The platform identifies learning gaps faster than paper-and-pencil assessments	4.39	0.72	Strongly agree
2	Real-time data enables intervention within 24–48 hours after signs of difficulty	4.24	0.77	Strongly agree
3	The dashboard flags students who remain stuck on a concept	4.11	0.81	Agree
4	Students trust platform data to predict which students are at risk of failing a unit	3.97	0.86	Agree
Targeted support and scaffolding				
1	The platform offers multiple explanations (e.g., video, text, interactive) after an unsuccessful attempt	4.43	0.70	Strongly agree
2	Content difficulty adjusts dynamically to avoid overwhelming at-risk students	4.29	0.74	Strongly agree
3	The platform provides scaffolding, such as hints or prerequisite review, when a student struggles	4.16	0.80	Agree
4	The platform provides sufficient remedial material to address foundational gaps	4.01	0.84	Agree
Teacher intervention				
1	The platform reduces stigma by allowing at-risk students to work privately on foundational skills	4.38	0.73	Strongly agree
2	The platform allows teachers to spend more one-to-one time with at-risk students	4.22	0.78	Strongly agree
3	Platform data helps teachers group students with similar at-risk profiles for small-group instruction	4.07	0.83	Agree
4	Platform data increases confidence in intervention strategies	3.95	0.87	Agree

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

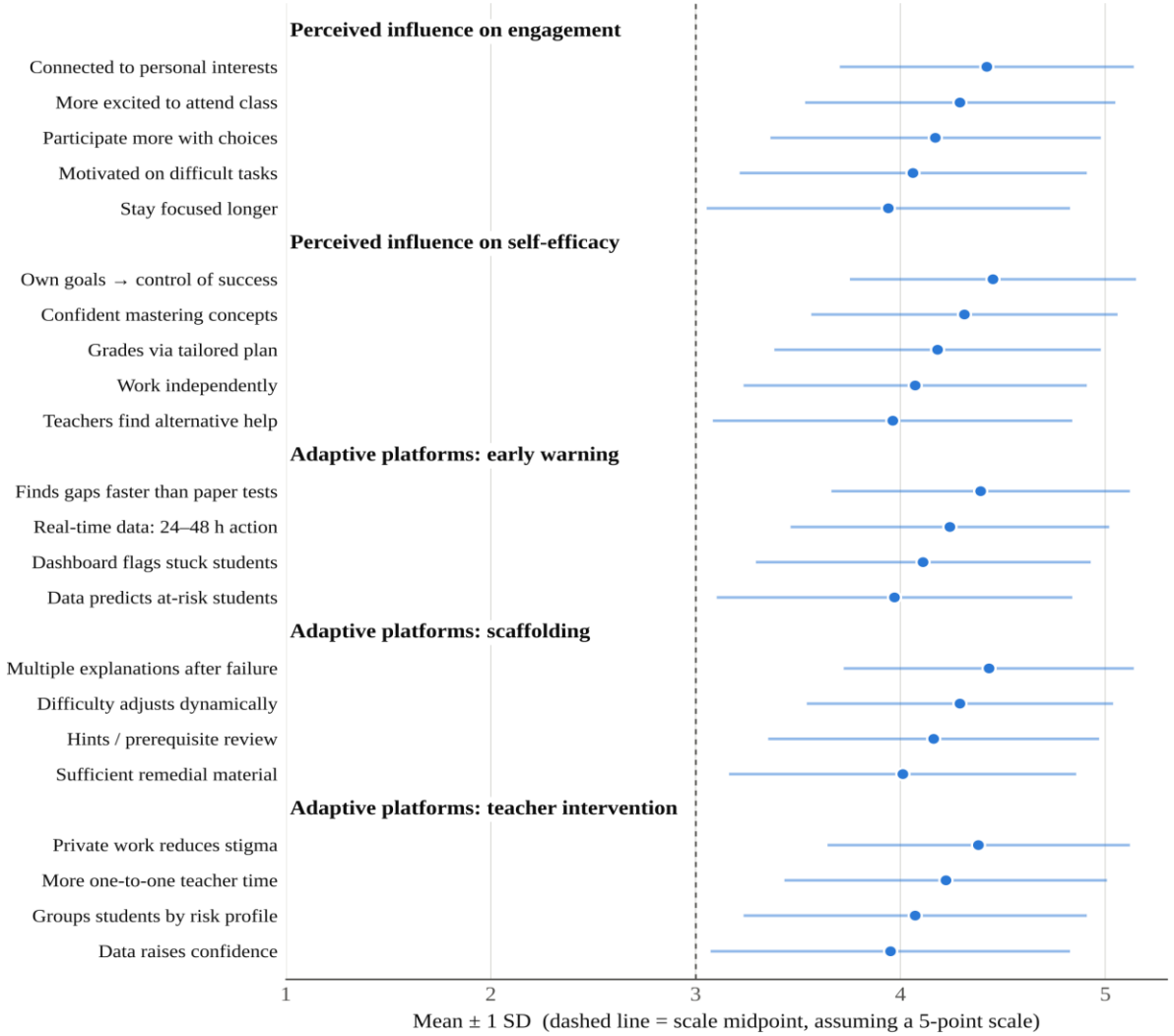

Figure 4. Item-level results for perceived influence on engagement and self-efficacy and for adaptive platforms (mean ± 1 *SD*).

4. Discussion

This study examined how teachers in three government colleges of Tehsil Faisalabad perceive personalized learning and adaptive technologies. The overall picture is one of enthusiasm tempered by practical concern. Teachers strongly endorsed the student-centered nature of personalized learning, its potential to raise engagement and strengthen students' sense of control, and the ability of adaptive platforms to detect gaps and scaffold learning. At the same time, the challenges they rated highest preparation effort, time and workload were rated as strongly as the most favored benefits. Teachers therefore appear to see personalized learning as pedagogically attractive but demanding to deliver.

High agreement that personalized learning is student-centered, that students should have a voice, and that teachers act as facilitators rather than sole sources of information suggests that participants hold conceptions of personalized learning that are broadly consistent with its learner-centered definition. The weak endorsement of the idea that personalized

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

learning means working alone on a computer all day (M = 2.74) indicates that many do not equate it with isolated screen-based study. Because teachers' pedagogical beliefs and competencies shape what they do in classrooms (Vieluf & Klieme, 2020), such beliefs are a favorable starting point, but they are not sufficient evidence of capacity to implement personalized learning. The survey measured agreement with statements, not classroom practice.

The highest-rated challenges were special preparation, time and the workload of managing multiple learning paths. This pattern echoes the finding of Sewagegn and Diale (2020) that limited instructional time constrained active learning under modular and block teaching. That study concerned a different instructional model and country, so the comparison is indicative only, but it illustrates a broader point: whether a learner-centered approach is feasible depends heavily on how time and workload are organized. The moderately high concern about data privacy when tracking individual learning (M = 4.03) is notable given teachers' simultaneous enthusiasm for data-driven monitoring; it implies that expanding adaptive technologies will require clear rules on how learner data are collected, stored and used. Concerns about cultural mismatch (M = 3.84) and contextual problems (M = 3.76) were weaker but still above the scale midpoint, suggesting that models developed elsewhere may need adaptation to the local setting.

Teachers' perceptions that choice, relevance to personal interests and self-set goals increase engagement and self-efficacy are consistent with discussions of learner autonomy and self-regulated learning (Nardo, 2017). They should not, however, be read as evidence that students' engagement or self-efficacy actually increases under personalized learning. Evidence on the effects of personalized approaches is mixed and the construct itself is contested (Prain et al., 2013). Student-reported measures or observation would be needed to test these perceptions.

Teachers' favorable views of adaptive platforms for early identification of gaps, multiple explanations, dynamic difficulty and private practice are in line with arguments that technology can help teachers monitor performance and identify remedial measures (Mandinach, 2012). Studies of blended and technology-supported instruction report positive outcomes in some contexts (Banditvilai, 2021; Mirari, 2022), but their effectiveness depends on context and implementation, which supports a cautious, evaluated rollout.

5. Conclusions

Teachers in the participating government colleges held favorable views of personalized learning and adaptive educational technologies. They were aware of the learner-centered principles behind personalized learning, expected it to enhance student engagement and self-efficacy, and saw adaptive platforms as useful for identifying learning gaps, providing scaffolding and supporting teacher intervention. They also identified substantial barriers: preparation effort, time, work-load and data privacy. The findings therefore point to the conditions under which implementation is likely to be feasible adequate teacher training, reliable technological infrastructure, workload management, data-protection rules and institutional planning rather than to technology alone. As the study measured perceptions in a convenience sample, it does not establish that personalized learning or adaptive platforms improve student learning; this should be tested in evaluated pilots.

REFERENCES

Banditvilai, C. 2016.Enhancing students' language skills through blended learning. Electronic Journal of e-Learning 14: 220-229.

Carmela, G. S., Ricardo and G. S. Bryon. 2021. Personalized learning and adaptive technology in Teaching Problem Solving. International Journal of Science Research 23:670-677.

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 7 • November 2026

Du Plooy, E., Casteleijn, D., & Franzsen, D. (2024). Personalized adaptive learning in higher education: A scoping review of key characteristics and impact on academic performance and engagement. *Heliyon, 10*(10), e39630. https://doi.org/10.1016/j.heliyon.2024.e39630

Lucas, A., E. J. Asir and J. H. Azing. 2020. Using personalized learning and adaptive technology to enhance oral and written communication skills. International Journal of Teaching 56: 163-172.

Mandinach, E. B. (2012). A perfect time for data-driven decision making among education practitioners. Educational Psychologist, 47(2), 71-85.

Mercer, N., & Howe, C. (2012). Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory. Learning, culture and social interaction, 1(1), 12-21.

Mirari, K. (2022). The effectiveness of adaptive learning systems in personalized education. Journal of Education Review Provision, 2(3), 107-115.

Nardo, M. T. B. (2017). Modular Instruction Enhances Learner Autonomy. American Journal of Educational Research, 5(10), 1024-1034.

Prain, V., Cox, P., Deed, C., Dorman, J., Edwards, D., Farrelly, C., Keeffe, M., Lovejoy, V., Mow, L., Sellings, P., Waldrip, B., & Yager, Z. (2013). Personalised learning: Lessons to be learnt. British Educational Research Journal, 39(4), 654–676.

Sewagegn, A. A., & Diale, B. M. (2019). Modular/Block teaching: Practices and challenges at higher education institutions of Ethiopia. Teaching in Higher Education, 26(6), 776–789. https://doi.org/10.1080/13562517.2019.1681391

Vieluf, S., & Klieme, E. (2023). Teaching effectiveness revisited through the lens of practice theories. In Theorizing teaching: Current status and open issues (pp. 57-95). Cham: Springer International Publishing.