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Adaptive Instructional Media for Higher-Order Thinking in Vocational Education: Teachers' Perceptions of Opportunities and Constraints

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ABSTRACT

Background: Adaptive instructional media are promoted to foster higher-order thinking skills (HOTS) in vocational education, yet little is known about how vocational teachers, who ultimately decide how such media are used, perceive their opportunities and constraints. **Purpose:** This study explored Office Management and Business Services (OMBS) teachers' perceptions of the opportunities, constraints, and support needs associated with adaptive instructional media, using the Smart Adaptive Learning Environment (SALE) as the case. **Method:** A qualitative descriptive design was employed. Semi-structured interviews were conducted with 25 OMBS teachers from vocational high schools in Lampung Province, Indonesia, and analysed through reflexive thematic analysis. **Results:** Twelve themes were generated. Teachers perceived four opportunities: scaffolded progression toward analysing, evaluating, and creating; personalised pathways for heterogeneous classes; progress data for instructional decisions; and gains in engagement and autonomy. Five constraints emerged: unstable connectivity and uneven devices (25 teachers), preparation time (25), difficulty designing graded analysing-to-creating items that fit lesson time, students' rushing and dependence, and phone-use rules. Teachers requested training, technical assistance, and a shared HOTS item bank (25), feature refinements, and phased implementation. **Conclusion:** Teachers viewed adaptive media as a practical means of differentiating HOTS instruction, but realising this potential depends less on the technology itself than on infrastructure readiness, time for item design, and collaborative teacher support.

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1. INTRODUCTION

Digital transformation and automation are changing the skills needed for vocational graduates who have to examine workplace challenges, evaluate options and generate solutions, not just perform procedures. The skills align with the analysing, evaluating and generating levels of the revised taxonomy of educational objectives, and are generally referred to as higher-order thinking skills (HOTS) (Anderson & Krathwohl, 2001; Liu et al., 2024). HOTS-oriented learning has become a curricular expectation in Indonesian vocational high schools (Sekolah Menengah Kejuruan, SMK), however, graduates are still reported to struggle with complex, non-routine work, and teachers' understanding and implementation of HOTS remain uneven (Prayitno & Jaedun, 2022; Rachmawati et al., 2023).

Instructional media have been used to fill such gaps for a long time. In an Indonesian secondary-school study, interactive multimedia combined with a discussion-based learning model made lessons more engaging and improved students' generic science skills significantly from pre-test to post-test (Nida et al., 2019). The adaptive instruction media extends this possibility. They can better serve heterogeneous courses than uniform education by adapting content, task complexity, sequencing, and feedback to each learner's progress (Shemshack & Spector, 2020). Reviews show beneficial impacts of personalised adaptive learning on academic performance and engagement (du Plooy et al., 2024). A study in Indonesia showed that adaptive learning improved learning outcomes of SMK students (Dly et al., 2025). However, a comprehensive evaluation of adaptivity in schools found that the majority of studies were undertaken in primary mathematics and adaptivity was given by systems and orientated mostly at performance (Bach et al., 2025). The Office Management and Business Services (OMBS) program developed the Smart Adaptive Learning Environment (SALE) as adaptive instructional media that explicitly targets the higher-order cognitive processes of analysing, evaluating and producing (C4–C6) with graded cases, evaluation and progress data.

Achieving HOTS via such media is very dependent on the teachers who set the timing of the media, the tasks the students undertake, and how to translate progress data into instructional action (Simon & Zeng, 2024; Van Schoors et al., 2023). Acting on student data requires data literacy, pedagogical skills and organisational support and the real-time data created by adaptive technologies place extra expectations on teachers (van Kessel, Horvers, et al., 2026). Teachers' intentions to use technology are affected by perceived utility, perceived ease of use, and facilitating conditions (Davis, 1989; Venkatesh et al., 2003), and first-order (external) and second-order (belief- and knowledge-related) barriers (Ertmer, 1999). In vocational education, teachers' digital competency and workload also influence the acceptance and usage of technology (Antonietti et al., 2022; Cattaneo et al., 2022).

Research on teachers' views of adaptive tools has mostly involved mathematics teachers or general and higher education settings (Kumor et al., 2024; Simon & Zeng, 2024). Comparing stakeholders indicates that teachers assess digital platforms in terms of instructional alignment and content structure, beyond usability factors (Suthiprapa et al., 2026). In Indonesian vocational schools, the low digital competence of teachers has recently been associated with limited infrastructure, time restrictions, and insufficient training (Rahmawati et al., 2025) and the preparedness of instructors to use technology has been modelled (Idrus et al., 2026). However, these research are not focused on adaptive instructional media for HOTS but on digital technology in general.

Consequently, there is little is known regarding vocational teachers' perceptions of potential and restrictions of adaptive instructional media to build students's HOTS. As

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opposed to earlier studies that have assessed adaptive products by means of expert validation, or student performance, or have surveyed teachers' general technology acceptance, this research the perspectives of OMBS teachers who have used such media in their own classrooms with their Indonesian vocational students.

This study, therefore, intends to investigate the perspectives of vocational OMBS teachers about adaptive instructional medium to develop HOTS of students. The research topics are: (1) What chances are seen by teachers in adaptable instructional media to develop students' analysing, evaluating and generating skills? (2) What are the limits that teachers feel in terms of pedagogy, technology, institution and students? (3) What assistance do teachers feel is necessary to successfully integrate adaptive instructional media?

2. METHODS

2.1. Research Design

A qualitative descriptive design was used to obtain a rich, low-inference account of teachers' perceptions. The design suited the exploratory research questions and the scarcity of prior evidence on adaptive media in vocational settings. Perceived usefulness, perceived ease of use, and facilitating conditions (Davis, 1989; Venkatesh et al., 2003), together with first- and second-order barriers to technology integration (Ertmer, 1999), sensitised the interview guide but did not constrain coding.

2.2. Participants and Setting

Participants were 25 OMBS teachers (coded T1–T25) selected purposively from three vocational high schools (SMK) in Bandar Lampung, South Lampung, and Tanggamus, Lampung Province, Indonesia. Inclusion criteria were (a) teaching OMBS subjects in Grade XI, (b) having used SALE with students through limited trial / classroom implementation, and (c) willingness to be interviewed. Table 1 summarises participant characteristics. Data were collected in September 2026.

Sample size was guided by the concept of information power (Malterud et al., 2016): the aim was narrow, participants were highly specific, and the dialogue was focused by a structured guide. No new codes emerged in the last fourteenth interviews, indicating that the data were sufficient for the research questions.

2.3. Instruments

The research questions and the theoretical lens were the basis for a semi-structured interview guide. It consisted of 19 major questions with probes in five domains: present HOTS practice (3 questions), experience with SALE (3), perceived opportunities (4), perceived restrictions (5), and support requirements (4). The guide was reviewed for relevance and clarity by two specialists in educational technology and vocational education and piloted with one OMBS teacher who was not part of the final sample.

2.4. Procedure

After school permission and individual consent were obtained, each teacher was interviewed individually in Bahasa Indonesia for approximately 45–60 minutes, face to face and online, after having used SALE with students. Interviews were audio-recorded and transcribed. Excerpts reported in this article were translated into English by the authors.

2.5. Data Analysis

Data were analysed through reflexive thematic analysis (Braun & Clarke, 2006, 2019). After repeated reading of all 475 responses (25 teachers × 19 questions), the first

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author generated initial codes inductively, grouped them into candidate sub-themes, and organised these into themes aligned with the three research questions. A codebook with definitions and indicative keywords was then applied systematically to every response so that the number of teachers expressing each sub-theme could be reported. Counts are presented only to indicate the prevalence of a perception, not as statistical evidence.

Trustworthiness was supported through member checking of interview summaries, peer debriefing among the authors, an audit trail of codebook versions and coding decisions, reflexive memos, and a thick description of the setting. Reporting followed the Consolidated Criteria for Reporting Qualitative Research (Tong et al., 2007).

2.6. Ethical Considerations

The study involved minimal risk and did not undergo review by an institutional ethics committee. Participation was entirely voluntary: teachers were informed of the purpose of the study, their right to withdraw at any time, and the confidentiality of their responses before giving consent to be interviewed. All participants were anonymised with codes (T1–T25), and no identifying information is reported.

3. RESULTS

Results are organised by research question, preceded by a description of teachers' current practice. Across the three research questions, 12 themes and 37 sub-themes were generated (Table 2; the full codebook is provided as a supplementary file). Figure 1 shows how the themes relate to each other.

Table 1. Participant characteristics.

School	Teachers	Gender (F/M)	Teaching experience (years)
SMK A	6	5/1	10-18
SMK B	5	4/1	7-12
SMK C	7	4/3	10-15
SMK D	3	3/0	7-10
SMK E	4	3/1	8-15

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Table 2. Themes and sub-themes of teachers' perceptions.

RQ	Theme	Sub-themes (number of teachers)	Illustrative excerpt
RQ1	Scaffolded progression toward C4–C6 reasoning	Stepwise analysis before decisions (22); weighing alternatives and consequences (13)	"understand the case gradually before making a decision" (T2)
RQ1	Personalised pathways for heterogeneous classes	Fast learners challenged (25); struggling learners strengthened (25); psychological safety (6)	"gain a conceptual foundation without feeling embarrassed" (T6)
RQ1	Progress data for instructional decisions	Targeted remediation (16); grouping and peer tutoring (2); reduced marking load (3); PKL/UKK readiness (3)	"works like a daily report card for me" (T6)
RQ1	Engagement, autonomy, and work readiness	Motivation (25); autonomy (22); digital work culture (11)	"just like the digital work culture in companies" (T8)
RQ2	Infrastructure and device constraints	Unstable internet under simultaneous use (25); uneven student devices (25)	"fluctuating internet connection when accessed simultaneously" (T3)
RQ2	Teacher preparation time and workload	Extra preparation time (25); digital skills adequate, time is the bottleneck (2)	"heavy at the initial preparation stage" (T21)
RQ2	Designing adaptive HOTS items	Fitting graded items into lesson time (14); authentic MPLB contexts (18); auto-scoring C5–C6 (4); mobile-readable stimuli (4)	"a clear automatic scoring rubric within the system" (T22)
RQ2	Student learning habits	Rushing and careless reading (14); dependence on teacher or peers (15)	"reminded to stay careful and not click at random" (T7)
RQ2	Institutional conditions	Supportive leadership (25); phone-use rules need adjustment (18)	"supervision just needs strengthening" (T6)
RQ3	Capacity building	Training (25); technical assistance (25); shared item bank (25); MGMP collaboration (3)	"sharing HOTS item banks among MPLB teachers" (T4)
RQ3	Feature refinement	Downloadable reports (9); alerts and grouping (5); explanatory feedback (4); reasoning visibility (4); mobile readability (3)	"see how students think until they reach their final answer" (T16)
RQ3	Phased implementation	Network readiness first (12); start small (10); use data for grouping and reflection (7)	"run a small-scale trial first" (T4)

3.1. Current Practice and HOTS Challenges

All 25 teachers combined short explanations, office case discussions, and computer-based practice, and 24 differentiated instruction manually through enrichment for fast learners and individual assistance for slower learners. Although teachers understood HOTS as analysing administrative problems, evaluating procedures, and producing documents independently, 21 set such tasks only two or three times per semester. The most frequently cited challenges were limited time in large classes (10), heterogeneous ability (7), rote-learning habits (7), low confidence (5), and difficulty diagnosing individual gaps (4). As T3 explained: "Many students are still used to waiting for step-by-step instructions and lack confidence when faced with open cases that demand independent analysis."

3.2. Perceived Opportunities (RQ1)

3.2.1. Scaffolded progression toward C4–C6 reasoning

Nearly all teachers (22) described SALE's graded items as leading students from understanding facts to analysing problems before deciding, and 13 emphasised that students had to weigh alternatives or consider consequences. T2 explained: "The question flow in SALE guides students to understand the case gradually before making a decision, so they are trained to analyse office work situations rather than merely guessing the answer." T16 added: "The branching flow in SALE trains students to see the consequences of every administrative decision, so their analytical and evaluative skills develop naturally."

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3.2.2. Personalised pathways for heterogeneous classes

All teachers valued that fast learners moved directly to harder cases while struggling learners first consolidated basic concepts. Six teachers framed this as psychological safety. T6 observed that "heterogeneous classes become more manageable because high-achieving students are immediately challenged at a high level, while weaker students gain a conceptual foundation without feeling embarrassed," and T24 noted: "Because they are not afraid of being laughed at by their friends when they are wrong, students dare to try analysing cases and evaluating their choices step by step."

3.2.3. Progress data for instructional decisions

Teachers reported using SALE's progress dashboard to decide who needed remediation or enrichment (16), to form groups or pair peer tutors (2), and to prepare students for internship and the competency examination (3); three highlighted reduced marking time. T6 explained: "The progress recap in SALE works like a daily report card for me. I can immediately map which indicators are most often answered incorrectly and make them the focus of discussion in the next meeting."

3.2.4. Engagement, autonomy, and work readiness

All teachers observed higher motivation and participation, 22 noted growing learner autonomy and self-monitoring, and 11 linked the experience to digital workplace practices. T8 stated: "Besides fostering enthusiasm for learning, this application accustoms students to working independently with system feedback, just like the digital work culture in companies."

3.3. Perceived Constraints (RQ2)

3.3.1. Infrastructure and device constraints

Every teacher identified unstable school internet, particularly when a whole class logged in simultaneously, together with uneven student phones in terms of specifications, battery, storage, or data. T3 identified the main obstacles as "fluctuating internet connection when accessed simultaneously by a full class, and several students' devices with limited specifications."

3.3.2. Teacher preparation time and workload

All teachers described the initial effort of mapping content and building graded items as time-consuming amid administrative duties. Two explicitly stated that their digital skills were adequate and that time, not skill, was the bottleneck. T21 put it this way: "The time investment does feel heavy at the initial preparation stage of compiling the adaptive item bank, although it saves a great deal of time during implementation and evaluation."

3.3.3. Designing adaptive HOTS items

Teachers found it demanding to keep items authentic to office and industry contexts (18) while fitting a graded C4–C6 sequence into one lesson (14). Others pointed to the difficulty of scoring evaluate and create responses automatically (4) and of writing case stimuli that remain readable on a phone screen (4). T22 described the greatest difficulty as "constructing evaluation and creation (C5–C6) items that still have a clear automatic scoring rubric within the system."

3.3.4. Student learning habits

Although students were enthusiastic, 14 teachers observed rushing and careless reading of instructions, and 15 noted continued dependence on the teacher or classmates.

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T7 remarked: "Students welcomed it very happily because the format resembles a digital challenge, although they still need to be reminded to stay careful and not click at random."

3.3.5. Institutional conditions

All teachers described school leadership as supportive of digital innovation, but 18 stressed the need for clearer rules and supervision of phone use. T6 noted: "School support is already good through the provision of Wi-Fi and permission to use devices for learning; supervision just needs strengthening so that students do not open other applications."

3.4. Support Needed (RQ3)

3.4.1. Capacity building

All 25 teachers requested the same three forms of support: practical training in designing adaptive HOTS scenarios and items, technical assistance during early implementation, and a shared bank of OMBS HOTS items. Three proposed developing these collaboratively through the subject teacher forum (MGMP) or small teacher teams. As T4 summarised: "The support most needed is training in creating adaptive question flows, regular technical assistance, and sharing HOTS item banks among MPLB teachers."

3.4.2. Feature refinement

Teachers suggested downloadable class reports aligned with curriculum learning outcomes (9), early alerts and automatic grouping recommendations (5), explanatory or motivating feedback after incorrect answers (4), views of students' reasoning paths and effort (4), and better readability of case documents on phones (3). T16 suggested: "A feature summarising students' decision paths should be added so that teachers can see how students think until they reach their final answer."

3.4.3. Phased implementation

When advising other schools, teachers recommended securing network readiness first (12), starting small with topics that most need analytical practice (10), and using progress data to plan grouping, remediation, and reflection (7). T4 advised: "Run a small-scale trial first, make sure the internet network is stable, and use the application's progress data as material for reflection together with students."

Figure 1 presents the thematic map. Opportunities were framed almost entirely around differentiation and data, whereas constraints were dominated by conditions outside the media itself, which in turn shaped the support teachers requested.

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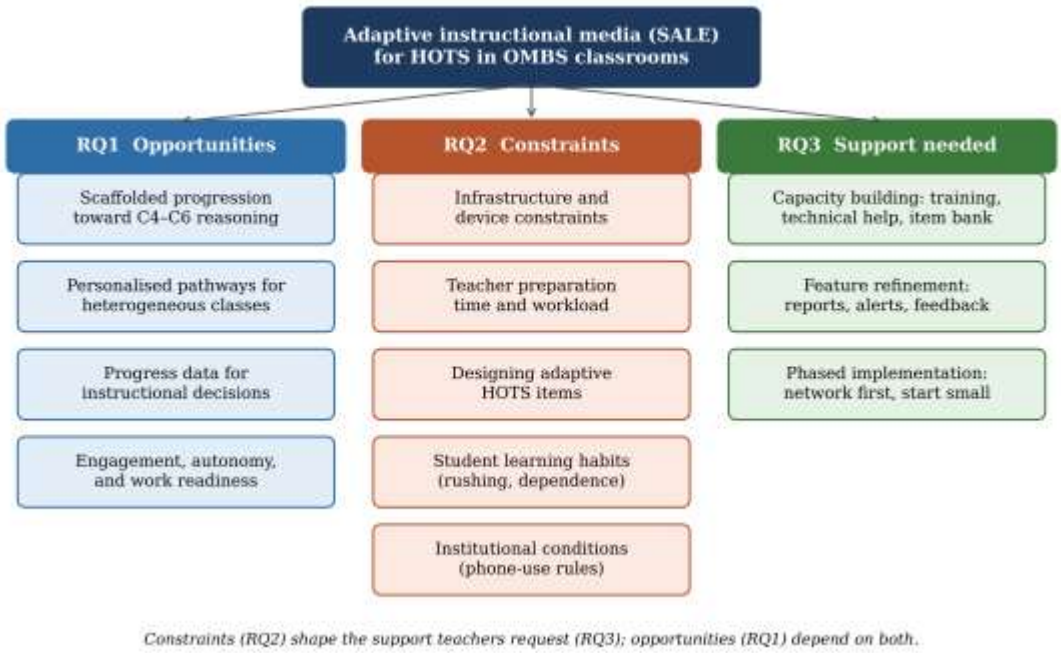


Figure 1. Thematic map of teachers' perceptions of adaptive instructional media.

4. DISCUSSION

Teachers perceived adaptive instructional media mainly as a means of differentiating HOTS instruction in classes they described as heterogeneous and time-constrained. This reflects their current practice, in which differentiation was managed manually and HOTS tasks were set only occasionally. Instructional differentiation is a complex practice that requires teachers to adapt several instructional elements simultaneously (Jager et al., 2025), and teachers appeared to value SALE precisely because it took over part of this complexity. The opportunities they identified correspond closely to perceived usefulness (Davis, 1989): graded items scaffold analysis before decision-making, personalised pathways keep fast and struggling learners engaged, and progress data indicate where to intervene. These perceptions are consistent with reports that teachers value adaptive tools for individualised practice and actionable information (Kumor et al., 2024; Simon & Zeng, 2024; Van Schoors et al., 2023) and with evidence that dashboards in adaptive technologies prompt targeted task and process feedback (van Kessel, Knoop-van Campen, et al., 2026). Teachers' observation that students became more motivated and active also echoes earlier evidence that interactive multimedia makes learning more engaging and supports the development of students' generic science skills (Nida et al., 2019). Two emphases were specific to the vocational context. First, teachers related analytical tasks and learner autonomy to workplace readiness, internships, and the competency examination. Second, several framed adaptivity as psychological safety for quiet or anxious students, a dimension rarely discussed in the adaptive learning literature yet relevant to the confidence barriers that Indonesian vocational teachers associate with HOTS (Prayitno & Jaedun, 2022).

The constraints were dominated by first-order barriers (Ertmer, 1999), namely connectivity, devices, preparation time, and phone-use rules. This mirrors findings that Indonesian vocational teachers face limited internet and hardware access, time constraints, and insufficient training (Rahmawati et al., 2025), and it reflects the facilitating conditions emphasised in acceptance models (Venkatesh et al., 2003); workload has likewise been identified as a factor in vocational teachers' digital

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competence (Cattaneo et al., 2022). However, the difficulty of designing graded C4–C6 items points to a second-order, pedagogical barrier. Teachers regarded their digital skills as adequate, yet writing authentic office cases that progress across cognitive levels, fit a single lesson, and can be scored automatically requires assessment-design expertise that general digital training does not provide. Developing adaptive test systems demands considerable item development and calibration even in dedicated projects (Firdaus et al., 2022), and techno-pedagogical competence, rather than operational skill alone, determines whether teachers integrate digital media meaningfully (Setiasih, 2021). This supports the view that HOTS-oriented learning in vocational schools depends on teachers' learning design capacity (Rachmawati et al., 2023). It also shows that adaptive media shift teachers' workload from marking to item design rather than eliminating it. Students' rushing and dependence further indicate that adaptivity alone does not produce careful reasoning; teachers still need to cultivate reading and self-regulation habits.

The support that teachers requested follows directly from these constraints. The unanimous call for training, technical assistance, and a shared item bank, together with proposals for collaboration through the subject teacher forum (MGMP), positions teachers as co-designers of adaptive content rather than end users. This echoes the conclusion that adaptive programmes succeed when teachers are involved as content creators and supported institutionally (Simon & Zeng, 2024), and evidence that co-design transforms teachers' understanding and enactment of personalised learning (Gunawardena et al., 2026). Professional development for differentiation is most effective when it is collaborative, active, and sustained (Langelaan et al., 2024), and teacher networks extend agency for digital change beyond individual classrooms (Kulmala et al., 2026). Training should also include hands-on use, because teachers' acceptance after use can differ markedly from their initial perceptions (Marlin et al., 2026). The features teachers requested, such as exportable reports aligned with learning outcomes, early alerts, grouping recommendations, and views of students' reasoning paths, indicate that teachers want data that fit their assessment and reporting routines and reveal thinking processes rather than only scores (van Kessel, Horvers, et al., 2026).

Together, the findings complement the expert validation and student-outcome evaluation carried out during the development of SALE by identifying the classroom conditions under which teachers believe such media can foster HOTS. Unlike studies that treat adaptivity mainly as a property of the system (Bach et al., 2025), this study shows that in vocational classrooms the decisive factors lie around the media: infrastructure readiness, time for item design, and collaborative teacher support.

4.1. Implications

The findings imply that media producers should focus on low-bandwidth or offline modes, curriculum-aligned and exportable reports, early alerts, and views of students's reasoning routes. They urge schools to ensure network bandwidth and restrictions of device use in advance before class-wide implementation, and to provide time for teachers to collaborate produce items through MGMP. Training for teacher professional development should focus on designing real, graded C4-C6 items and on acting on progress data, rather than on managing the application. Theoretically, the study adds to technology-acceptance studes in vocational education (Antonietti et al., 2022; Idrus et al., 2026) by identifying item design as a second-order barrier that remains even when teachers consider their digital abilities sufficient.

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4.2. Limitations and Future Research

This study has several limitations. First, participants came from one programme in one province and had used SALE, a medium developed by the research team; their perceptions may therefore be more favourable than those of teachers using other adaptive tools, and social desirability cannot be ruled out. The predominantly positive and convergent responses should be read with this in mind. Second, the data reflect self-reported perceptions rather than observed practice. Future research should triangulate teacher interviews with classroom observation and students' HOTS outcomes, include teachers using other adaptive platforms and other vocational programmes, and follow teachers longitudinally as they design their own adaptive items.

5. CONCLUSION

Vocational OMBS teachers perceived adaptive instructional media as a promising means of fostering students' analysing, evaluating, and creating skills. They valued graded items that scaffold reasoning, personalised pathways that serve heterogeneous classes, progress data that inform remediation and grouping, and gains in engagement and autonomy. The constraints they reported, however, lay mostly outside the media: unstable connectivity and uneven devices, limited time for preparation, the difficulty of designing authentic graded C4–C6 items, students' hasty and dependent learning habits, and unclear phone-use rules. Teachers therefore called for training, technical assistance, a shared HOTS item bank, refined reporting features, and phased implementation. Realising the potential of adaptive media for HOTS in vocational schools thus depends on investing in teachers as collaborative designers of adaptive content and on securing the infrastructure that makes adaptivity possible.

6. AUTHORS' NOTE

Author Contributions. Ria Rahma Nida: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, Project administration, Funding acquisition. Dewi Nurmalasari: Investigation, Data curation, Validation, Writing – review & editing. Ervina Maulida: Formal analysis, Validation, Visualization, Writing – review & editing. Ferry Setyadi Atmadja: Resources, Supervision, Writing – review & editing. All authors read and approved the final manuscript.

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Conflict of Interest. The authors declare no conflict of interest.

Ethics Statement. This study did not undergo review by an institutional ethics committee. Participation was voluntary, all teachers gave informed consent before being interviewed, and their identities were anonymised.

Data Availability Statement. Anonymised interview data and the codebook are available from the corresponding author upon reasonable request.

Use of Generative AI. The authors used generative AI tools to tidy the writing and improve language use in this research, including the results of the interviews with teachers and the manuscript. The authors reviewed and verified all AI-assisted text, conducted the analysis and interpretation themselves, and take full responsibility for the content of this publication.

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7. REFERENCES

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education? *Computers in Human Behavior, 132*, 107266. https://doi.org/10.1016/j.chb.2022.107266

Bach, K. M., Hofer, S. I., & Bichler, S. (2025). Adaptive learning, instruction, and teaching in schools: Unraveling context, sources, implementation, and goals in a systematic review. *Learning and Individual Differences, 124*, 102781. https://doi.org/10.1016/j.lindif.2025.102781

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health, 11*(4), 589–597. https://doi.org/10.1080/2159676X.2019.1628806

Cattaneo, A. A. P., Antonietti, C., & Rauseo, M. (2022). How digitalised are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors. *Computers & Education, 176*, 104358. https://doi.org/10.1016/j.compedu.2021.104358

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dly, H. P., Erwis, F., Jufri, J., & Setiawan, A. (2025). Efektivitas adaptive learning terhadap hasil belajar siswa SMK pada mata pelajaran jaringan komputer. *Edutech, 24*(3), 1405–1413. https://doi.org/10.17509/e.v24i3.85160

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*(21), e39630. https://doi.org/10.1016/j.heliyon.2024.e39630

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61. https://doi.org/10.1007/BF02299597

Firdaus, F., Huda, A., Irfan, D., & Hebdriyani, Y. (2022). Pengembangan sistem computer adaptive test (CAT) dengan pendekatan item response theory (IRT). *Edutech, 21*(3), 272–286. https://doi.org/10.17509/e.v21i3.51978

Gunawardena, M., Patahuddin, S., Pino-Pasternak, D., Aviruppola, K., & Bishop, P. (2026). Empowered teachers: Navigating the dynamics of personalised learning through co-design. *Teaching and Teacher Education, 181*, 105714. https://doi.org/10.1016/j.tate.2026.105714

Idrus, A., Pratama, R., Saudagar, F., Yusra, A., & Wijaya, H. A. (2026). Digital literacy and technology adoption readiness of vocational school teachers: An extended UTAUT model in Indonesia. *Social Sciences & Humanities Open, 14*, 103501. https://doi.org/10.1016/j.ssaho.2026.103501

Jager, L., Denessen, E., Cillessen, A. H. N., & Meijer, P. C. (2025). Instructional differentiation in secondary education: Teachers' actions and reasoning. *Teaching and Teacher Education, 159*, 105009. https://doi.org/10.1016/j.tate.2025.105009

Kulmala, S., Kangas, K., Hakkarainen, K., & Korhonen, T. (2026). Teachers' transformative professional agency: Inspiration and means for promoting educational change in the context of digitalization. *Teaching and Teacher Education, 181*, 105742. https://doi.org/10.1016/j.tate.2026.105742

Kumor, T., Uribe-Flórez, L., Trespalacios, J., & Yang, D. (2024). ALEKS in high school mathematics classrooms: Exploring teachers' perceptions and use of this tool. *TechTrends, 68*(3), 506–519. https://doi.org/10.1007/s11528-024-00955-0

Langelaan, B. N., Gaikhorst, L., Smets, W., & Oostdam, R. J. (2024). Differentiating instruction: Understanding the key elements for successful teacher preparation and development. *Teaching and Teacher Education, 140*, 104464. https://doi.org/10.1016/j.tate.2023.104464

Liu, J., Liu, Z., Wang, C., Xu, Y., Chen, J., & Cheng, Y. (2024). K-12 students' higher-order thinking skills: Conceptualization, components, and evaluation indicators. *Thinking Skills and Creativity, 52*, 101551. https://doi.org/10.1016/j.tsc.2024.101551

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: Guided by information power. *Qualitative Health Research, 26*(13), 1753–1760. https://doi.org/10.1177/1049732315617444

Marlin, K., Brandt-Pomares, P., Laisney, P., Castéra, J., & Mascret, N. (2026). Beyond initial perceptions: A quasi-experimental study of how hands-on training shapes teachers' mobile learning acceptance. *Computers in Human Behavior Reports, 23*, 101248. https://doi.org/10.1016/j.chbr.2026.101248

Nida, R. R., Suyatna, A., & Wahyudi, I. (2019). Implementasi multimedia interaktif dalam pembelajaran fisika berbasis CORE terhadap keterampilan generik sains siswa. *Edutech, 18*(3), 264–276. https://ejournal.upi.edu/index.php/edutech/article/view/17334

Prayitno, S. H., & Jaedun, A. (2022). Technical education teachers' perception on higher order thinking skills and their ability to implementation it in Indonesia. *Jurnal Pendidikan Vokasi, 12*(3), 245–256. https://doi.org/10.21831/jpv.v12i3.54335

Rachmawati, D., Suharno, S., & Roemintoyo, R. (2023). The effects of learning design on learning activities based on higher order thinking skills in vocational high schools. *Open Education Studies, 5*(1), 20220202. https://doi.org/10.1515/edu-2022-0202

Rahmawati, S., Prestridge, S., Abdullah, A. G., & Widiaty, I. (2025). Unpacking the digital competence challenge in vocational education: A case from Indonesia. *Social Sciences & Humanities Open, 12*, 101803. https://doi.org/10.1016/j.ssaho.2025.101803

Setiasih, O. (2021). Techno-pedagogy: What is the role of prospective teachers in preparing for learning in the digital era? *Edutech, 20*(3), 237–255. https://doi.org/10.17509/e.v20i3.40688

Shemshack, A., & Spector, J. M. (2020). A systematic literature review of personalized learning terms. *Smart Learning Environments, 7*(1), 33. https://doi.org/10.1186/s40561-020-00140-9

Simon, P. D., & Zeng, L. M. (2024). Behind the scenes of adaptive learning: A scoping review of teachers' perspectives on the use of adaptive learning technologies. *Education Sciences, 14*(12), 1413. https://doi.org/10.3390/educsci14121413

Suthiprapa, K., Nguyen, L. T., Manakul, T., Han, S., Srisawasdi, N., Sarakorn, W., Poonpon, K., Somabut, A., Kanjug, I., & Tuamsuk, K. (2026). Digital learning platforms for classroom teaching: Perceptions of teachers and students in Thailand's smart learning initiative. *Social Sciences & Humanities Open, 13*, 102866. https://doi.org/10.1016/j.ssaho.2026.102866

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care, 19*(6), 349–357. https://doi.org/10.1093/intqhc/mzm042

van Kessel, M., Horvers, A., de Jonge, M., Molenaar, I., & Saab, N. (2026). From data to action: A systematic review of what teachers need to act on static and real-time student data in primary education. *Teaching and Teacher Education, 182*, 105768. https://doi.org/10.1016/j.tate.2026.105768

van Kessel, M., Knoop-van Campen, C. A. N., de Jonge, M., Molenaar, I., & Saab, N. (2026). Feedback practices with teacher dashboards in primary education: Exploring dashboard-prompted feedback across lesson phases. *Computers & Education, 249*, 105615. https://doi.org/10.1016/j.compedu.2026.105615

Van Schoors, R., Elen, J., Raes, A., Vanbecelaere, S., & Depaepe, F. (2023). The charm or chasm of digital personalized learning in education: Teachers' reported use, perceptions and expectations. *TechTrends, 67*(2), 315–330. https://doi.org/10.1007/s11528-022-00802-0

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

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