

## **Examining the Effects of Differentiated Digital Instruction on English Language Teaching in Inclusive Classrooms**

Gaukhar Yersultanova<sup>1</sup> & Roza Sadykova<sup>2</sup> & Eldana Janserkeyeva<sup>3</sup> & Gulbagira Saurukova<sup>4</sup>

### **Abstract**

This study aimed to examine the challenges teachers face in differentiated digital instruction in inclusive English language classrooms and to investigate its effects on students' English achievement and attitudes. The study was designed as an exploratory mixed-method study. In the qualitative phase, data were collected from 27 English teachers through semi-structured interviews to explore their experiences, professional development needs, and support expectations. In the quantitative phase, a pre-test–post-test control group design was implemented with 52 inclusive 7th-grade students. The experimental group received differentiated digital instruction, while the control group followed traditional textbook-based instruction. Data were analyzed using content analysis and Mann–Whitney U tests. The findings indicate that teachers experience difficulties related to time constraints, lack of resources, and the management of student diversity. However, they demonstrate a strong interest in professional development and emphasize the need for practical and application-oriented support. Quantitative results show that differentiated digital instruction has a positive effect on students' English achievement and attitudes compared to traditional instruction. These findings suggest that differentiated digital instruction can support inclusive teaching practices when combined with appropriate pedagogical design and institutional support.

**Keywords:** *Teacher support needs, Professional development, Differentiated digital instruction, Inclusive classrooms, Student attitudes, Academic achievement*

### **Introduction**

In current education policies, inclusive education is positioned as an approach that treats learner diversity as a natural and enduring characteristic and aims to ensure the participation of all students at the systemic level. This approach represents a holistic understanding of education that includes not only students with special needs but all learners with different readiness, interests, and learning profiles. However, the literature emphasizes that because of the lack of connection between the theoretical framework of inclusive education and classroom practices, it is not possible to sustain

---

<sup>1</sup> Abai Kazakh National Pedagogical University, Kazakhstan, e-mail: gyersultanova@gmail.com

<sup>2</sup> Corresponding Author, Kazakh National Women's Teacher Training University, Kazakhstan, e-mail: r.sadykova@qyzpu.edu.kz

<sup>3</sup> Kazakh Ablai Khan University of International Relations and World Languages, Kazakhstan, e-mail: janserkeyeva.e@qyzpu.edu.kz

<sup>4</sup> Kazakh Ablai Khan University of International Relations and World Languages, Kazakhstan, e-mail: saurukova.g@qyzpu.edu.kz

inclusivity without considering the organizational structures and pedagogical processes of the school together (Nilholm, 2021; Rapp & Corral-Granados, 2024).

With the digital transformation, instructional design, assessment, and classroom management dimensions of inclusive education are being reshaped. The accessibility, interaction, and personalization capabilities of digital tools are considered an important resource supporting inclusive teaching (Akande et al., 2025; Kakogianni et al., 2025). The applicability of universal design and differentiation principles in digital environments is among the fundamental mechanisms that strengthen equal opportunities in inclusive education. However, the inclusive use of digital tools requires ensuring harmony between pedagogical aims and technical applications, and it is emphasized that equitable technology integration should be addressed together with differentiation-based instructional designs (Hutson & McGinley, 2023; Taga, 2026).

In the context of English language teaching, inclusive classrooms are defined as complex learning environments where different language levels and learning profiles coexist. In this context, differentiated digital instruction has the potential to respond to learner diversity by offering teachers flexibility regarding content, process, and product dimensions (Busri & Jamil, 2025). It has been reported that digital differentiation supports learning processes through data-driven monitoring, multiple modalities, and real-time feedback and can increase language learners' academic achievement, self-regulation, and engagement levels (Griful-Freixenet et al., 2020; Meşe & Mede, 2023). However, the implementation of differentiated digital instruction in inclusive EFL classrooms is closely related to teacher competencies, attitudes, and professional development opportunities. It has been observed that the pedagogical, temporal, and structural difficulties that teachers encounter in differentiation practices, as well as their digital competency levels, determine the quality of implementation (Letzel et al., 2023). Moreover, the effects of technology-supported instructional designs on affective variables are decisive in terms of outcomes such as foreign language anxiety, motivation, and classroom participation (Chen & Shih, 2025; Tleubay et al., 2025; Yeleussiz, 2024).

The literature reveals a limited number of empirical studies that holistically address differentiated digital instruction within the context of inclusive English-language learning (EFL), examining both learning outcomes and teacher processes together. This study aims to examine the effects of differentiated digital instruction in inclusive English-language classrooms based on evidence,

generating implications for practice, teacher training, and educational policies. In this respect, the study aims to fill a significant gap in the literature regarding the effectiveness and sustainability of differentiated digital instruction in the field of inclusive EFL.

### **Differentiated Digital Instruction in Inclusive English Language Classrooms**

Inclusive education is conceptualized as an approach where all students' participation and learning opportunities are systematically guaranteed, and inclusive classrooms are seen as multi-layered structures where heterogeneous needs are met in the same learning environment. However, it is emphasized that theoretical explanations of inclusive education are insufficient to transform practice and that the theory-practice relationship needs to be strengthened (Nilholm, 2021), and it is argued that inclusivity should be considered together with the school system and the processes of making meanings within the classroom (Rapp & Corral-Granados, 2024). In this regard, differentiated instruction is defined as making planned adaptations in terms of content, process, and product dimensions according to learners' readiness, interests, and learning profiles, and it is stated that teachers' perceptions and application tendencies regarding differentiation change in a context-sensitive manner (Yuen et al., 2022). In inclusive English classrooms, differentiation is recognized as organizing components such as access to language input, production opportunities, and feedback intensity, and the principles offered by universal design for learning provide a framework that strengthens the alignment of differentiation with inclusion goals (Griful-Freixenet et al., 2020). Therefore, in inclusive English classrooms, differentiation is a systematic pedagogical orientation integrated with the principles of equity and accessibility, and differentiated digital instruction is a restructuring of this orientation through the multiple representational and interactive capacity of digital tools.

Digital pedagogy is described as offering a multidimensional framework that reorganizes teaching processes through technology, encompassing dimensions such as content delivery, interaction mechanisms, feedback loops, and data-driven monitoring (Jiang et al., 2025; Zafeer et al., 2025). The personalization capacity of digital environments makes differentiation more visible and traceable in inclusive classrooms (Kakogianni et al., 2025), but it is noted that the claim of personalization can generate new forms of exclusion when not validated by the principles of accessibility and equity (Akande et al., 2025). Digital accessibility and UDL compatibility are stated to be fundamental conditions for inclusive technology integration (Taga, 2026), and it is

accepted that the digital tools in inclusive EFL classrooms enhance access to input with options such as subtitling, text-to-speech, visual support, and speed adjustment. Teacher training and professional development are considered an element that enhances the pedagogical depth of digital differentiation (Pongsakdi et al., 2021), and teacher attitudes are shown to guide differentiation practices (Letzel et al., 2023).

The implementation of differentiated digital instruction in inclusive English classrooms is seen as closely related to teacher competencies and school ecology, and it is stated that teacher competencies consist not only of technical skills but also of pedagogical design and assessment knowledge components. Teacher self-efficacy is shown to be a determining factor in inclusive education practices (Woodcock et al., 2022), and empathy, teaching motivation, and inclusive competency variables play a mediating role in prospective teachers' attitudes towards inclusive education (Jiang et al., 2025). Digital literacy and digital pedagogy are stated to be resources that strengthen teacher preparation for inclusive classrooms (Abiloye, 2025; Begimbetova et al., 2025; Hamakali & Josua, 2023; Magocha et al., 2025; Orakova et al., 2024), but it is noted that technology integration faces obstacles such as infrastructure inequality, accessibility issues, and lack of institutional support in inclusive programs (Busri & Jamil, 2025). Differences have been reported between the digital competencies of EFL teachers and their ability to translate these competencies into pedagogical practice (Salsabila et al., 2025), and teacher professional development has been shown to have positive effects on digital pedagogical competence, self-efficacy, and work well-being (Shi et al., 2025). Thus, differentiated digital instruction in inclusive English classrooms is an integrated area of practice that should be addressed together with teacher preparation, institutional support, and accessibility principles.

### **Effects of Differentiated Digital Instruction on Language Skills and Student Engagement**

The effects of differentiated digital instruction on language skills are explained through mechanisms such as access to input, production opportunities, and feedback quality, and it has been shown that digital differentiation can produce positive results on achievement and self-regulation in EFL learners (Meşe & Mede, 2023). It is stated that technology integration within the framework of blended learning supports skill development by offering flexible scheduling and multitasking design in language teaching (Indriana et al., 2026), and that interactive and personalized digital learning experiences can increase students' active participation in the learning

process (Kakogianni et al., 2025). In differentiated digital instruction, feedback is positioned not only as a means of providing corrective information but also as a mechanism guiding learning strategies. It has been also observed that AI-based assessment and feedback applications can produce effects on writing performance and learning attitudes (Biju et al., 2024). Data-driven personalization balances cognitive load by adjusting task difficulty to suit the student's needs, and it is emphasized that adaptive systems should support personalized pedagogy with a design-based approach (Nwachukwu et al., 2025). Hence, the development of language skills depends on differentiation decisions being structured in a way that is consistent with learning objectives.

Student engagement, motivation, and affective variables are considered critical outcomes in explaining the effectiveness of differentiated digital instruction, and differentiated instruction is reported to produce significant effects on classroom engagement, motivation, and self-efficacy (Chen & Shih, 2025). Technology-based interaction designs have been shown to support engagement by reducing foreign language anxiety, and the availability of anonymous participation, controlled production, and incremental feedback options in digital environments is seen as a factor that strengthens psychological safety (Biju et al., 2024). AI-based personalization and emotion recognition approaches are stated to increase engagement while also affecting students' perception of privacy and ethical concerns (Ding & Xue, 2025), and it is accepted that engagement should be evaluated not only with behavioral indicators but also with cognitive and affective dimensions. Digital differentiation increases task retention by allowing students to progress at their own pace, but student engagement may decrease in the absence of accessibility mechanisms, and this may weaken inclusion goals (Akande et al., 2025). Therefore, the impact of differentiated digital instruction on participation depends on the combined operation of affective safety, task meaningfulness, and accessibility components.

### **Implementation of Differentiated Digital Instruction and Challenges in Inclusive EFL Contexts**

The implementation of differentiated digital instruction within the context of inclusive EFL is addressed through accessibility-based design, teacher competence, and institutional support, and it is stated that technology-supported inclusive education should be systematically structured through digital accessibility and UDL principles (Akande et al., 2025). It is emphasized that equitable technology integration in inclusive education requires arrangements to decrease the risks

of inequality brought about by digital transformation (Taga, 2026), and challenges related to technology integration in inclusive programs are reported to be associated with infrastructure, teacher readiness, and sustainable support mechanisms (Busri & Jamil, 2025). Teacher digital competencies play a decisive role in translating platform-provided opportunities into differentiation decisions (Salsabila et al., 2025), and it is reported that differentiation experiences in distance learning generate significant difficulties in meeting student needs (Alzahrani et al., 2022). Adaptive learning systems are reported to support personalized pedagogy with design-oriented approaches and to scale differentiation (Nwachukwu et al., 2025), and so implementation success depends on the simultaneous establishment of accessibility, teacher competence, and appropriate digital design.

The difficulties encountered during the implementation process are discussed along with the dimensions of teacher professional development and institutional preparedness. It is stated that digital pedagogy acts as a catalyst in teacher education and prepares prospective teachers for the use of inclusive technology (Msimango, 2025), and that prospective teachers' digital literacy is related to their inclusive education competencies (Abiloye, 2025). Institutional preparedness at the university and school levels is crucial in the sustainable implementation of digital pedagogy (Omarsaib, 2025), and it is reported that digital pedagogical professional development produces positive effects on teacher competence, self-efficacy, and job well-being (Shi et al., 2025). It is stated that the blended learning approach can systematize differentiation practices by structuring technology integration (Indriana et al., 2026), and it is emphasized that digitalization can reproduce inequalities when accessibility mechanisms are not strengthened (Akande et al., 2025). Hence, implementing differentiated digital instruction within the context of inclusive EFL requires the combined operation of teacher training, institutional preparation, and ethical-accessibility standards.

### **Research Objective and Questions**

The current research has two main purposes. The first is to identify the characteristics of differentiated digital instruction based on teacher narratives and to examine how these characteristics relate to teacher professional development needs and support systems. The second purpose is to examine the impact of differentiated digital instruction on English achievement and attitudes of inclusive students compared to traditional teaching.

In this context, the following research questions were addressed:

1. What characteristics (qualitative narratives) of differentiated digital instruction are perceived by English teachers in inclusive ELT classrooms, and how do these characteristics quantify in terms of implementation dimensions (content, process, product adaptations, accessibility features)?
2. How are teachers' perceived challenges and support needs (qualitative narratives regarding task adaptation, pedagogical support, professional development, and institutional preparedness) reflected in their expectations for effective differentiated instruction implementation?
3. What themes emerge from teacher narratives regarding the connection between differentiated digital instruction design (qualitative characteristics such as task differentiation, accessibility, and feedback mechanisms) and the competence required to support inclusive learner success?
4. Is there a statistically significant difference in English achievement between inclusive students receiving differentiated digital instruction (experimental group) and those receiving traditional instruction (control group)?
5. Is there a statistically significant difference in attitudes toward English lessons between inclusive students receiving differentiated digital instruction (experimental group) and those receiving traditional instruction (control group)?

## **Method**

### **Research Design**

This study was designed as an exploratory mixed-method study in which qualitative and quantitative data were used sequentially to address different but related dimensions of differentiated digital instruction in inclusive English language teaching contexts. Mixed-method research enables researchers to obtain a more comprehensive understanding of a research problem by integrating qualitative exploration with quantitative examination (Creswell & Plano Clark, 2018; Johnson et al., 2007). In the qualitative phase, the study first explored English teachers' experiences, perceived challenges, professional development expectations, and support needs

regarding differentiated digital instruction in inclusive classrooms. This phase was intended to generate an in-depth understanding of how differentiated digital instruction is perceived and what kinds of pedagogical, institutional, and material conditions are considered necessary for its effective implementation. In the quantitative phase, the study examined the effect of a differentiated digital instruction intervention on inclusive 7th-grade students' English achievement and attitudes toward English lessons by using a pre-test–post-test control group experimental design. In this phase, the experimental group received differentiated digital instruction, whereas the control group continued with textbook-based traditional instruction. Pre-test and post-test comparisons were conducted to determine whether the intervention produced statistically significant differences between the two groups.

The overall logic of the design was exploratory because the qualitative findings were used to frame the instructional focus of the study and to contextualize the subsequent quantitative examination. However, the two strands addressed different units of analysis—teachers in the qualitative phase and students in the quantitative phase. Therefore, the study does not claim a fully embedded integration of datasets; rather, it uses qualitative exploration to strengthen the interpretation and contextual grounding of the experimental findings.

### **Research Group**

The research was conducted with two different study groups. The qualitative dimension of the research consisted of 27 teachers working in government schools in Kazakhstan. Participants were included in the research on a voluntary basis. Criterion sampling, a type of purposeful sampling method, was used to determine the research group. In this regard, the main criteria were that the participants were actively teaching and had at least a basic level of knowledge about differential teaching. When the demographic characteristics of the participating teachers were examined, it was seen that 18 of the participants were female and 9 were male. In terms of professional seniority, 6 teachers had 1-5 years, 8 had 6-10 years, 7 had 11-15 years, and 6 had 16 years or more of seniority. Regarding participants' experience levels with differential teaching methods, only 1 teacher (3.7%) stated that they had basic experience, while 10 (37.0%) rated themselves as post-beginners/less experienced, 7 (25.9%) as intermediate and 9 of them (33.3%) as advanced/professional.

The experimental phase of the study was conducted in the 7th grade classes of schools in central Almaty during the 2025 academic year. The sample consisted of 52 inclusive students in the 7th grade. The selection criteria/profiles of the inclusive students for the experimental and control groups were determined as follows:

- Students with mild learning disabilities (slow in reading and writing)
- Students with attention deficit/attention disorder
- Students with slow language development
- Students with low self-esteem and high anxiety levels

In the randomized study, the experimental group consisted of 26 students and the control group also consisted of 26 students. In both groups, 13 students were male and 13 were female. The groups had a balanced distribution in terms of gender and special learning needs. Before the study, students in both groups, their teachers, and their families were informed about the process and their informed consent was obtained.

### Experimental Application

In the experimental group, a teaching program designed based on the differentiated digital instruction approach was applied in "English Lesson". The application and its activities which were carried out are presented in Table 1.

**Table 1**

*Six-Session English Lesson with Differentiated Digital Instruction Application*

| Sessions                                                         | Topics               | Objectives                                                                    | Activities                                                                                                                                                                                     |
|------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SESSION 1 Safe Learning Environment & Getting to Know Each Other | Greetings & Feelings | Student feeling himself safe.<br>Simple greetings and expressions of emotion. | Emoji-supported greeting video<br>Digital emotion cards (happy, sad, excited)<br>Differentiation:<br>-Supported group: Single word selection<br>-Standard group: Short sentence ("I am happy") |
| SESSION 2 – Teaching Basic Vocabulary                            | Daily Routines       | - Recognizing everyday routine words<br>-Learning with visual cues            | Wordwall image-word matching<br>Optional tasks:<br>- Match 3 words<br>- Mini sorting with 5 words                                                                                              |
| SESSION 3 – Listening & Controlled Speaking                      | At School            | - Listening comprehension<br>- Producing single words or short phrases        | Slow-motion video + pause<br>Speech cards:<br>"School" – "Teacher" – "Friends"                                                                                                                 |

|                                                           |                      |                                                                                             |                                                                                                     |
|-----------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| SESSION 4<br>Reading<br>(Simplified Digital<br>Text)      | My<br>Hobbies        | - Extracting meaning<br>from short, well-<br>supported texts                                | Large font, short digital text<br>Differentiation:<br>-Answer by selecting an image<br>-Mark Yes/No |
| SESSION 5 –<br>Writing /<br>Alternative<br>Expression     | My Friend            | - Ability to express<br>oneself<br>- Offering alternative<br>products instead of<br>writing | With a Canva template:<br>-Writing a name<br>-Selecting an image<br>-Audio narration (optional)     |
| SESSION 6 –<br>Reinforcement &<br>Emotional<br>Reflection | Review &<br>Feelings | - To review what has<br>been learned<br>- To create emotional<br>awareness                  | Game-based quiz (no scoring pressure)<br>Self-assessment with emojis                                |

### **Adaptations Based on BEP Components within the Scope of Differentiated Digital Instruction in the Experimental Group**

#### ***a) Long-Term Goal***

The students will be able to understand basic English vocabulary and phrases through digitally supported activities and express themselves in at least one form of expression (verbal/visual).

#### ***b) Short-Term Goals***

- Recognize at least 5 words related to daily routines with visual support
- Express a simple greeting using a single word or symbol
- Participate in a guided digital activity

**Table 2**

*Session-Based SBP Adaptation Table (Experimental Group)*

| Session | Standard Objective        | SBP Application             | Digital Support         |
|---------|---------------------------|-----------------------------|-------------------------|
| 1       | Greeting phrases          | Single word/emoji selection | Padlet – Emoji cards    |
| 2       | Describing daily routines | 3-word match                | Wordwall                |
| 3       | Listening comprehension   | Pause video                 | Edpuzzle                |
| 4       | Reading comprehension     | Responding with a picture   | Canva                   |
| 5       | Paragraph writing         | Audio narration             | Audio recorder          |
| 6       | General review            | Participation through games | Kahoot (score disabled) |

#### *Instructional Process Adaptations*

- *Time adaptation:* Activities are short and divided
- *Instruction adaptation:* Simple, single-step, audio + visual
- *Material adaptation:* Large font, little text, high contrast

- *Response adaptation*: Marking/voiceover instead of writing

In the control group, instruction was conducted using traditional methods according to the textbook, with students in the same grade and inclusive education. After 6 weeks of simultaneous interventions in both groups, they were administered an English achievement scale and an English attitude scale as post-tests.

## **Data Collection Tools**

### ***Qualitative Data Collection Tools***

Qualitative data were collected through a semi-structured interview form developed to explore teachers' experiences and perspectives regarding differentiated digital instruction in inclusive English language classrooms. The interview form was designed not merely as a checklist, but as a qualitative instrument consisting of different types of questions, including general questions, informative questions, argumentative questions, and personal questions, in order to obtain rich and explanatory data.

The first part of the form included background questions aimed at identifying the professional profiles of the participating teachers. These questions focused on demographic and professional characteristics such as gender, years of teaching experience, and prior experience with differentiated instructional practices. This section was used to contextualize the participants' responses and to better understand the professional backgrounds from which their views emerged.

The second part consisted of open-ended questions designed to investigate teachers' views, experiences, and expectations concerning differentiated instruction in inclusive classrooms. In this section, teachers were asked about the challenges they encounter in implementing differentiated instruction, the kinds of professional development they need, the topics they would like to see covered in a training program, and the forms of institutional or instructional support required for more effective practice. In addition, teachers were asked which differentiated learning topics they considered most relevant for inclusive English classes and what kinds of classroom elements they believed were necessary to improve the quality of instruction for inclusive students.

The interview form was prepared in line with the purpose of the study and was reviewed by three field experts in terms of scope, clarity, and language. Based on expert feedback, the form was revised and finalized. A pilot interview was conducted with one participant to assess the

comprehensibility and applicability of the questions. Following the pilot implementation, minor linguistic revisions were made, and the final version of the interview form was prepared for data collection. Prior to the interviews, informed consent was obtained from all participants, and participation was based on voluntariness.

### ***Quantitative Data Collection Tools***

#### ***English Achievement Test***

An English Achievement Test developed by the researchers was used to assess students' learning outcomes in English. It was prepared via using the curriculum and various resources. Experts in special education, English, and assessment were consulted regarding its suitability for the characteristics of inclusive students. At this stage, content validity of the test was sought. A pilot application was conducted based on expert opinions. The final version of the test was decided considering the results of the pilot application. After item analysis of the Academic Achievement Test, the KR-20 reliability coefficient was calculated as .85. The test includes vocabulary, grammar, and sentence structure questions and consists of a total of 20 questions.

#### ***English Lesson Attitude Scale***

To determine the attitudes of 7th grade students towards English lessons, a scale consisting of statements in three areas—cognitive, affective, and behavioral—was used, developed by the researchers. Each item on the scale was rated as follows: “strongly agree=5”, “agree=4”, “neutral=3”, “disagree=2”, “strongly disagree=1”. The English Lesson Attitude Scale, which is a Likert-type measurement tool, consists of 10 positive and 10 negative items. The validity and reliability study of the scale was conducted by the researchers, and the factor analysis revealed a unidimensional structure. The Cronbach's Alpha ( $\alpha$ ) internal consistency coefficient of the scale was calculated as 0.87, and the scale was considered usable.

### ***Data Analysis Techniques***

The qualitative data obtained within the scope of the research were analyzed using the content analysis method. It is an analytical approach that aims to systematically classify and interpret similar qualitative data within the framework of specific concepts and themes (Krippendorff, 2018). Accordingly, the data obtained from semi-structured interviews were first transcribed and then examined in detail in line with the purpose of the research. In the analysis process, the

interview texts were first read multiple times to identify meaningful expression units, and open coding was performed based on these units. Codes with similar content were grouped together into categories, and these categories were further grouped under sub-themes and themes at a higher level. At this stage, care was taken to ensure consistency among the data and that the themes reflected the teachers' opinions holistically. The coding and theme creation process was carried out based on the inductive analysis approach recommended in qualitative research (Miles et al., 2014). To increase the reliability of the research, the coding process was carried out systematically. The created themes and sub-themes were organized to be consistent with the research questions. In the presentation of the findings, direct quotations were used to directly and clearly reflect the teachers' opinions. The analysis results are presented in tables structured as Theme – Sub-Theme – Category – Direct Quote and Teacher Number. To protect participant privacy, teachers are coded as T1, T2, T3...

Quantitative data were analyzed using statistical software (SPSS 27.0). Kolmogorov-Smirnov and Shapiro-Wilk tests were applied to determine whether the pre-test and post-test scores of both groups showed a normal distribution. Due to the non-normal distribution and the number of participants in each group being less than 30, the pre-test and post-test results of the "English Achievement Test and English Attitude Scale" were compared using the Mann-Whitney U test. It is used to test whether the scores of two independent groups differ significantly (Wall Emerson, 2023).

## **Findings**

### ***Findings Related to the Qualitative Research Questions***

The qualitative findings are presented in line with the first two research questions. Specifically, this section reports teachers' views on the challenges they experience in implementing differentiated digital instruction in inclusive English language classrooms, as well as their professional development needs, course-related expectations, and support requirements for improving instructional effectiveness. Table 3 presents the descriptive findings related to these themes.

**Table 3**

*Findings on the challenges teachers face in differentiated digital instruction and their professional development interests.*

| Question                                                                              | Choices                                                      | N  | %    |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------|----|------|
| 1. What challenges do you encounter in differential teaching?                         | Student diversity / Managing differences                     | 15 | 55,6 |
|                                                                                       | Lack of resources                                            | 11 | 40,7 |
|                                                                                       | Lack of time                                                 | 9  | 33,3 |
|                                                                                       | I don't know effective methods                               | 6  | 22,2 |
| 2. How interested are you in professional development in differential teaching?       | I am very interested / Quite interested                      | 23 | 85,2 |
|                                                                                       | I am moderately interested / Average interested              | 4  | 14,8 |
|                                                                                       | I am slightly interested / Little interested                 | 0  | 0,0  |
|                                                                                       | Not interested.                                              | 0  | 0,0  |
| 3. What topics would you like to cover in the differential equations teaching course? | Artificial intelligence and the use of artistic intelligence | 3  | 12,5 |
|                                                                                       | Student diversity planning                                   | 3  | 12,5 |
|                                                                                       | Art and creativity topics                                    | 2  | 8,3  |
|                                                                                       | English teaching                                             | 2  | 8,3  |
|                                                                                       | Methodological support                                       | 2  | 8,3  |
|                                                                                       | Planning                                                     | 2  | 8,3  |
|                                                                                       | Programming                                                  | 2  | 8,3  |
|                                                                                       | Identifying students' learning needs                         | 2  | 8,3  |
|                                                                                       | Approach to student differences in lessons                   | 2  | 8,3  |
|                                                                                       | Other                                                        | 4  | 16,7 |
| 4. What support is needed to increase the effectiveness of differential instruction?  | Funding resources / Financial support                        | 3  | 13,0 |
|                                                                                       | Platform for sharing ideas/experiences                       | 3  | 13,0 |
|                                                                                       | Teaching materials / Methodological resources                | 2  | 8,7  |
|                                                                                       | Development of thinking skills                               | 2  | 8,7  |
|                                                                                       | Mentoring/consulting for teachers                            | 2  | 8,7  |
|                                                                                       | Pedagogical support                                          | 2  | 8,7  |
|                                                                                       | Professional development opportunities                       | 2  | 8,7  |
|                                                                                       | Developing student-appropriate approaches                    | 2  | 8,7  |
|                                                                                       | Other                                                        | 5  | 21,7 |

*Since multiple choices are allowed in questions 1, 3, and 4, the sum of the percentages may exceed 100%.*

The findings presented in Table 3 show that teachers most frequently struggle with managing student diversity and differences (55.6%) in differentiated digital instruction applications. This is followed by insufficient resources (40.7%) and insufficient time (33.3%), while some teachers stated that they did not have sufficient knowledge of effective methods (22.2%). In contrast, the

vast majority of teachers showed a high level of interest in professional development related to differential instruction (85.2%).

The differential teaching course revealed that teachers' expectations varied. Particularly highlighting demands for the use of artificial intelligence and artistic intelligence, planning work with student differences in mind and creativity-based content. In addition, teachers emphasized the need for subject-specific content and methodological support. To increase the effectiveness of differential teaching, teachers primarily indicated a need for structural and professional support, such as financial assistance, platforms that facilitate experience sharing, and access to teaching materials.

Table 4 presents teachers' expectations regarding the content of differential teaching courses, categorized by theme, sub-theme, and category, with direct quotes from teachers' opinions.

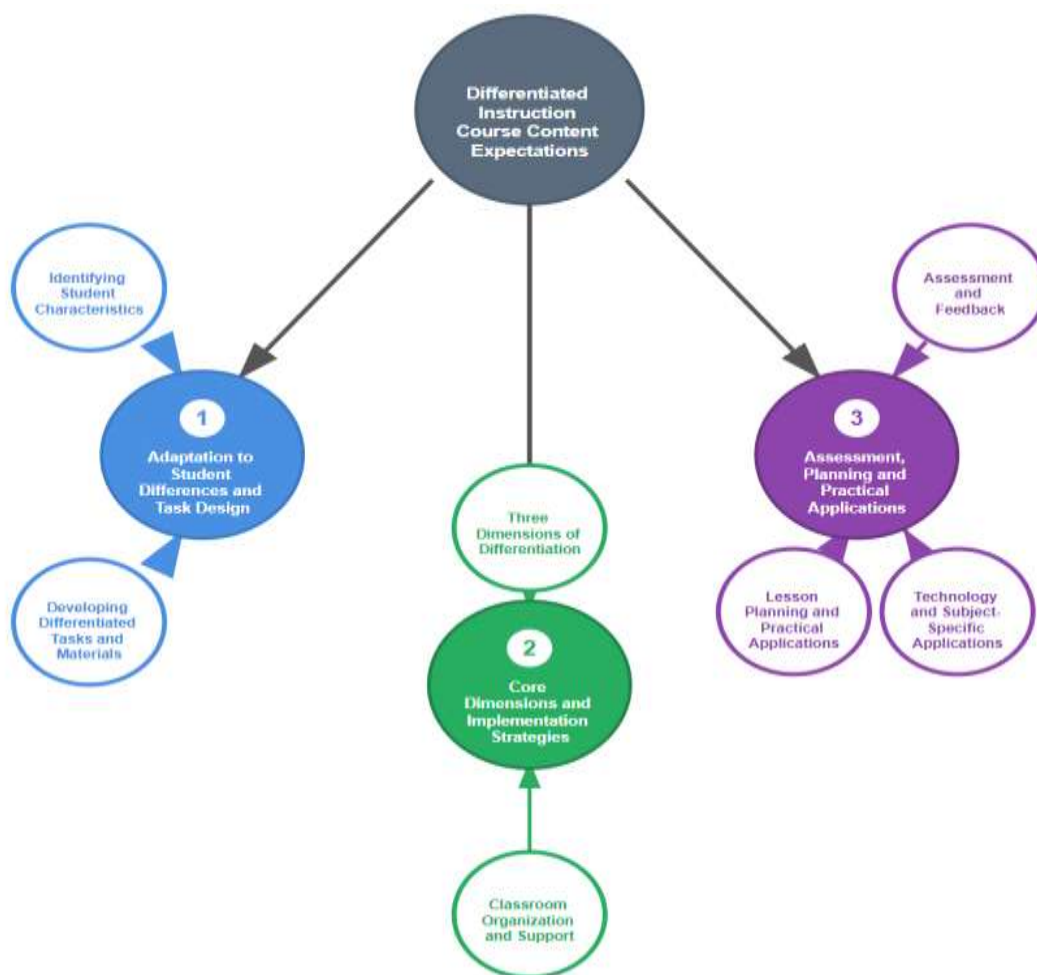
**Table 4**  
*Differential Learning Course Content Expectations*

| Theme                                                              | Sub-theme                                    | Category                                            | Direct Quote                                                                                                                        |
|--------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Adapting and Designing Tasks According to Student Differences      | Determining Student Characteristics          | Determining the level of knowledge and skills.      | "I would like to see how we will determine the level of knowledge and skills" (T6)                                                  |
|                                                                    |                                              | Recognizing individual characteristics              | "I want to take into account the characteristics of the students: learning level, interests, learning speed, learning style" (T11)  |
|                                                                    |                                              | Ways to determine learning level                    | "I would like the issue of ways to determine the students' level to be addressed" (T17)                                             |
|                                                                    | Differentiated Task and Material Development | Task preparation according to level                 | "I want the assignments to be appropriate for the students' level, including individual and group work" (T12).                      |
|                                                                    |                                              | Tasks categorized by difficulty level.              | "I expect the topic of tasks according to difficulty level to be covered" (T11)                                                     |
|                                                                    |                                              | Examples for strong and weak students               | "I would like to request examples of tasks for both strong and weak students" (T6)                                                  |
| Key Dimensions and Application Strategies of Differential Teaching | Three Dimensions of Differentiation          | Content differentiation                             | "I want the issues of differentiation through content, process and outcome to be addressed" (T1)                                    |
|                                                                    |                                              | Process differentiation                             | "I expect the issue of differentiating the process to be addressed" (T5)                                                            |
|                                                                    |                                              | Product/outcome differentiation                     | "I want to see how to differentiate the product (result)" (T11)                                                                     |
|                                                                    | Classroom Organization and Support           | Flexible grouping and working arrangements.         | "I want to see flexible grouping, working with different levels and tempos" (T7)                                                    |
|                                                                    |                                              | Working with students of varying motivation levels. | "I want to see ways to work with motivated and undermotivated students, and to support talented and underperforming students" (T15) |

| Theme                                           | Sub-theme                                  | Category                                      | Direct Quote                                                                                                                                                                                       |
|-------------------------------------------------|--------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Evaluation, Planning and Practical Applications | Evaluation and Feedback                    | Differentiated assessment methods             | <i>"I would like the assessment methods in differential instruction to include formative and summative assessment topics" (T18)</i>                                                                |
|                                                 |                                            | Evaluation and feedback processes             | <i>"I would like to see the issue of evaluation and feedback in differentiated approach conditions" (T9)</i>                                                                                       |
|                                                 | Lesson Planning and Practical Applications | Planning according to different needs         | <i>"I want to plan lessons taking into account the different needs of students and to see examples from school practice" (T4)</i>                                                                  |
|                                                 |                                            | Practical methods and examples                | <i>"I would like to see practical differential teaching methods: leveled tasks, taking individual needs into account, material adaptation, evaluation, and examples from school practice" (T3)</i> |
|                                                 |                                            | Successful practices and case studies         | <i>"I would like to see examples of successful practices and case studies from different schools, practical examples of effectively using differentiation in the classroom" (T17)</i>              |
|                                                 |                                            | Technology and Industry-Specific Applications |                                                                                                                                                                                                    |
|                                                 |                                            | Digital tools and artificial intelligence     | <i>"I want to learn about the use of digital technologies and the use of artificial intelligence as a teacher's personal assistant" (T2)</i>                                                       |
|                                                 |                                            | Branch-specific differentiation               | <i>"In language class (English), I want to learn about differential teaching examples, how to differentiate listening tasks" (T18)</i>                                                             |

The findings in Table 4 show that teachers' expectations regarding differential instruction course content are concentrated on a structure that is application-oriented, centers on student differences, and is supported by concrete examples. Teachers particularly emphasized the identification of students' knowledge, skills, and individual characteristics, and the design of tasks and materials appropriate to these differences. In addition, addressing the fundamental dimensions of differential instruction—content, process, and product differentiation strategies—through classroom applications emerged as an important expectation.

In terms of assessment and planning, it was determined that teachers need support in differentiated assessment methods, feedback processes, and lesson planning according to different needs. Furthermore, teachers consider it important that the course content includes practical applications, successful case studies, digital tools, the use of artificial intelligence, and subject-specific (English) differentiation examples. These findings reveal that teachers are more inclined towards content that can be directly applied to classroom practices rather than purely theoretical knowledge.



**Figure 1**

*Themes and Sub-themes Emerging from Content Expectations*

Table 5 presents teachers' opinions on the types of support needed to increase the effectiveness of differential instruction, organized by theme, sub-theme, and category.

**Table 5**

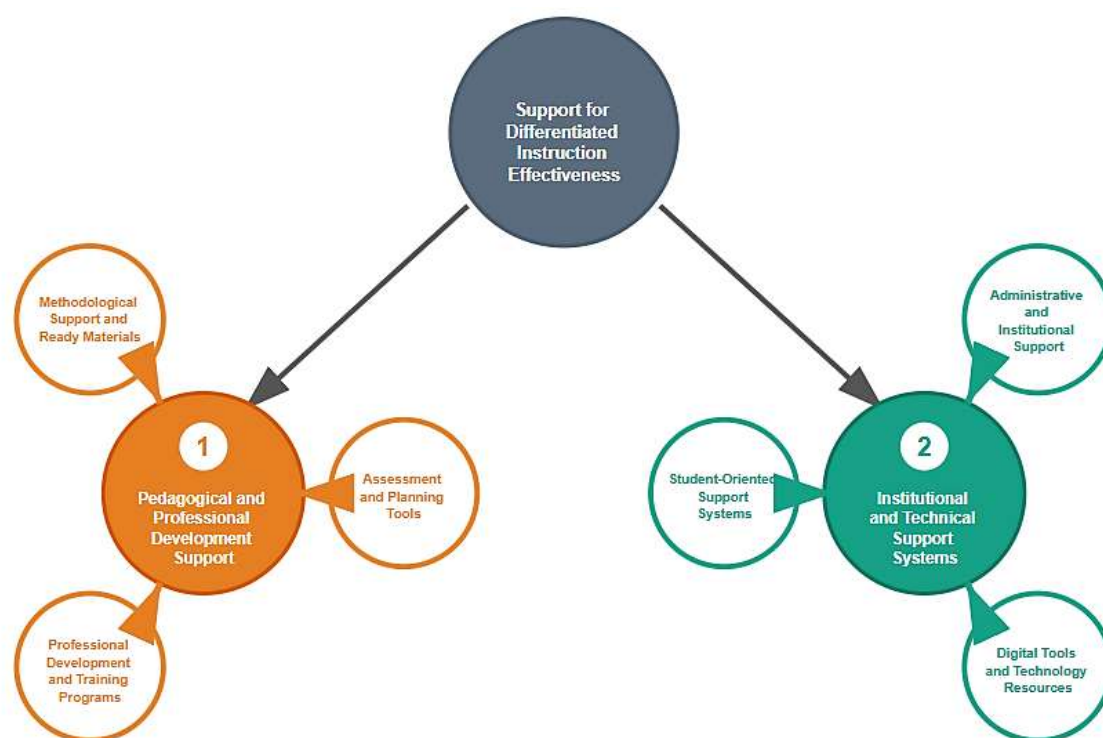
*Opinions on the Support Needed to Increase the Effectiveness of Differential Teaching*

| Theme                                            | Sub-theme                                      | Category                                                 | Direct Quote                                                                                                                                      |
|--------------------------------------------------|------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Pedagogical and Professional Development Support | Methodological Support and Available Materials | Methodological guidance and readily available resources. | "Teachers need methodological support, ready-made task examples, proper time planning and tools to determine students' level" (T1)                |
|                                                  |                                                | Ready-made task banks and lesson plans.                  | "We need intelligent programs that can prepare tasks of varying difficulty levels in seconds so that we don't have to work on them at night" (T2) |

| Theme                                   | Sub-theme                                      | Category                                                                                                                                      | Direct Quote                                                                                                                                                                                              |
|-----------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Corporate and Technical Support Systems | Professional Development and Training Programs | Access to digital and educational resources                                                                                                   | "Methodological recommendations, practical examples and ready-made differentiated tasks should be provided to improve teachers' qualifications and ensure access to digital educational resources" (T3)   |
|                                         |                                                | Continuous education and workshops                                                                                                            | "Masterclasses and seminars on differential strategies should be organized, and methodological advice should be given on adapting different tasks to different student levels" (T6)                       |
|                                         |                                                | Coaching and mentoring support                                                                                                                | "Coaching and mentoring should be provided as professional support" (T4)                                                                                                                                  |
|                                         |                                                | Practical trainings                                                                                                                           | "Continuous training and master classes should be provided on differential teaching, and opportunities for exchange of experience should be given" (T12)                                                  |
|                                         | Assessment and Planning Tools                  | Level determination and evaluation tools                                                                                                      | "It is important that assessment tools and digital technologies that help determine students' level are accessible" (T16)                                                                                 |
|                                         |                                                | Time management and planning                                                                                                                  | "It is necessary to plan time effectively and give teachers time to prepare lessons" (T1, T12)                                                                                                            |
|                                         | Management and Corporate Support               | School administration support                                                                                                                 | "Support should be obtained from the school administration, the teacher should be given time to prepare the lesson, and the number of students in the class should be taken into consideration" (T5, T12) |
|                                         |                                                | Flexibility and autonomy                                                                                                                      | "It is important that the principal allows grading based on the student's individual achievement, and that the teacher is allowed to adapt and use methods to their own class" (T2, T12)                  |
|                                         |                                                | Collaborative work environment                                                                                                                | "Support from colleagues and management is required; systematic support from the entire school community is necessary" (T17, T12).                                                                        |
|                                         | Digital Tools and Technological Resources      | Digital platforms and tools                                                                                                                   | "Textbooks and supplementary materials, digital platforms and interactive tools should be provided for each level" (T12)                                                                                  |
| Technology-supported teaching tools     |                                                | "Digital tools and management support are necessary" (T7, T9)                                                                                 |                                                                                                                                                                                                           |
| Student Support Systems                 | Level-appropriate guidance and materials       | "Students should be provided with guidance and support materials appropriate to their level" (T11)                                            |                                                                                                                                                                                                           |
|                                         | Motivation and psychological support           | "It is necessary to increase students' motivation, develop their self-confidence, and establish systematic communication with families" (T12) |                                                                                                                                                                                                           |

The findings in Table 5 show that teachers primarily need pedagogical and professional development support to enhance the effectiveness of differential instruction. In this context, methodological guidance, ready-made task banks, lesson plans, and access to digital educational resources stand out as important requirements. Teachers also emphasized the need for practical training such as continuous professional development, workshops, coaching, and mentoring.

Moreover, level assessment and evaluation tools, time management and planning support, school administration and institutional support, teacher autonomy, and a collaborative school culture are considered critical for the sustainability of differential instruction. Digital platforms and technology-supported teaching tools, as well as student guidance, motivation, and psychological support, were also cited by teachers as complementary elements that increase effectiveness.



**Figure 2**  
*Themes and Sub-themes Emerging in Terms of Support*

### ***Findings Related to the Quantitative Research Questions***

To answer the quantitative research questions, the findings were presented in terms of students' English achievement and attitudes toward English lessons, based on pre-test and post-test comparisons between the experimental and control groups. As a first step, pre-test results were examined to determine whether the two groups were comparable before the intervention. Table 6 presents the descriptive statistics for the pre-test English achievement scores of the inclusive students, and Table 7 presents the results of the Mann–Whitney U test comparing the two groups.

**Table 6.** Descriptive Statistics of Pre-Test English Achievement Scores of Inclusive Students

| PreTest     | Group        | N  | Mean | Std. Deviation |
|-------------|--------------|----|------|----------------|
| Achievement | Experimental | 26 | 7,12 | 3,36           |

|         |    |      |      |
|---------|----|------|------|
| Control | 26 | 7,35 | 2,81 |
|---------|----|------|------|

Table 6 presents the descriptive statistics for the pre-test English achievement scores of the inclusive students in the experimental and control groups. The mean pre-test score was 7.12 (SD = 3.36) for the experimental group and 7.35 (SD = 2.81) for the control group. To examine whether the groups differed significantly before the intervention, a Mann–Whitney U test was conducted. The results of this comparison are presented in Table 7.

**Table 7**

*Whitney U Test Results of Inclusive Students' Pre-Test English Achievement*

| Group        | N  | Mean Rank | Sum of Ranks | Mann Whitney U<br>Z | P     |
|--------------|----|-----------|--------------|---------------------|-------|
| Experimental | 26 | 25,85     | 672,00       | -0,313              | 0,755 |
| Control      | 26 | 27,15     | 706,00       |                     |       |
| Total        | 52 |           |              |                     |       |

Table 7 shows the results of the Mann Whitney U test calculated between the pre-test English Achievement test rank mean scores of both groups. According to the analyses, a Z value of 0.313 was calculated between the English Achievement test ranks of the groups. This Z value did not lead to a significant difference at the 0.05 significance level. The research indicates that there is an equivalence in terms of English Achievement in the groups before the experimental interventions.

**Table 8**

*Descriptive Statistics of Pre-Test English Attitude Scores of Inclusive Students*

| PreTest  | Group        | N  | Mean | Std. Deviation |
|----------|--------------|----|------|----------------|
| Attitude | Experimental | 26 | 2,88 | 0,71           |
|          | Control      | 26 | 3,00 | 0,69           |

Table 8 shows the pre-test results of the English attitude scale for inclusive students in the experimental group and the control group. According to the analyses, the mean English achievement test score of the experimental group was 2.88 (Sd=0.71), and the mean attitude score

of the control group was 3.00 (Sd=0.69). The results of the comparison between the attitude score rankings of the groups are shown below in Table 9.

**Table 9**

*Mann Whitney U Analysis of Pre-Test English Attitude Scores of Inclusive Students*

| PreTest  | Group        | N  | Mean Rank | Sum of Ranks | Z      | p     |
|----------|--------------|----|-----------|--------------|--------|-------|
| Attitude | Experimental | 26 | 25,58     | 665,00       | -0,539 | 0,590 |
|          | Control      | 26 | 27,42     | 713,00       |        |       |
|          | Total        | 52 |           |              |        |       |

Table 9 shows the results of the Mann Whitney U test calculated between the pre-test English attitude scale rank mean scores of the experimental and control groups. According to the analyses, a Z value of 0.539 was calculated between the English attitude scale ranks of the two groups. This Z value does not have a significant difference at the 0.05 significance level. There is equivalence between the groups regarding English attitudes before the experimental applications.

**Table 10**

*Descriptive Statistics of Inclusive Students' Post-Test English Achievement Test Scores*

| PostTest    | Group        | N  | Mean  | Std. Deviation |
|-------------|--------------|----|-------|----------------|
| Achievement | Experimental | 26 | 14,12 | 2,70           |
|             | Control      | 26 | 11,73 | 3,12           |

Table 10 shows the English Achievement post-test results of the inclusive students in the experimental group and the control group. According to the analyses, the mean English Achievement post-test score of the experimental group was 14.12 (Sd=2.70), while the mean score of the control group was 11.73 (Sd=3.12). The results of the comparison between the post-test score rankings of the groups are shown below in Table 11.

**Table 11**

*Mann Whitney U Test Results of Inclusive Students' Final Test English Achievement*

| PostTest    | Group        | N  | Mean Rank | Sum of Ranks | Z      | p     |
|-------------|--------------|----|-----------|--------------|--------|-------|
| Achievement | Experimental | 26 | 31,60     | 821,50       | -2,441 | 0,015 |
|             | Control      | 26 | 21,40     | 556,50       |        |       |
|             | Total        | 52 |           |              |        |       |

Table 11 shows the results of the Mann Whitney U test calculated between the mean post-test English Achievement scores of both groups after the application of the research. According to the analyses, a Z value of 2.441 was calculated between the post-test English Achievement score rankings of the two groups. According to this finding, a significant difference was found between the post-test score rankings of them at 0.05 significance level ( $p < 0.05$ ). According to detailed analyses, students in the experimental group achieved significantly higher English Achievement than those in the control group.

**Table 12**

*Descriptive Statistics of Inclusive Students' Post-Test English Attitude Scores*

| PostTest | Group        | N  | Mean | Std. Deviation |
|----------|--------------|----|------|----------------|
| Attitude | Experimental | 26 | 4,08 | 0,98           |
|          | Control      | 26 | 3,42 | 0,64           |

Table 12 shows the post-test results of the English attitude scale for inclusive students in both groups. According to the analyses, the mean post-test score for the experimental group was 4.08 ( $Sd=0.98$ ), while the mean score for the control group was 3.42 ( $Sd=0.64$ ). The results of the comparison between the post-test scores of the groups are shown below in Table 13.

**Table 13**

*Mann Whitney U Test Results of Inclusive Students' Post-Tests on English Attitudes*

| PostTest | Group        | N  | Mean Rank | Sum of Ranks | Z      | p     |
|----------|--------------|----|-----------|--------------|--------|-------|
| Attitude | Experimental | 26 | 32,02     | 832,50       | -2,772 | 0,006 |
|          | Control      | 26 | 20,98     | 545,50       |        |       |
|          | Total        | 52 |           |              |        |       |

Table 13 shows the results of the Mann Whitney U test calculated between the mean post-test scores of the experimental and control groups on the English attitude scale after the application process. According to the analyses, a Z value of 2.772 was calculated between the post-test rank scores of both groups. A significant difference was found between the post-test attitude score ranks of the two groups at the 0.05 significance level ( $p < 0.05$ ). According to the analyses, students in the experimental group acquired positive and high-level attitudes towards English compared to their peers in the control group.

## **Discussion and Conclusion**

The current research reveals the experiences and training needs of teachers in the context of differentiated digital instruction in inclusive English classrooms, and also examines the effects of these practices on student outcomes. It also explains the difficulties teachers encountered during the implementation process and their needs for professional development. Moreover, it is observed that teachers' expectations regarding course content are concentrated on components that are transferable to practice and subject-specific. Quantitative findings show that differentiated digital instruction creates a more positive trend in student achievement and attitudes towards the course compared to traditional instruction. In this context, the research shows that digital pedagogy gains meaning through design decisions that are consistent with the principles of inclusivity.

### **Interpretation of the Findings**

The research first examined the challenges teachers face in differentiated digital instruction. The findings show that teachers struggle particularly with managing student diversity, time constraints, and the burden of preparing materials. Insufficient access to resources is considered a condition that weakens the sustainability of digital differentiation. Furthermore, it appears that some teachers perceive themselves as lacking in effective methodological knowledge. This suggests that technology use may remain at the level of tool knowledge and that the pedagogical design dimension needs to be strengthened. Väättäjä and Ruokamo (2021) stated that digital pedagogy offers a multidimensional design framework. Yuen et al. (2022) revealed that context can be decisive in responding to student diversity. Letzel et al. (2023) reported that teacher attitude profiles affect the applicability of differentiation. Busri and Jamil (2025) emphasized that technology integration in inclusive programs can encounter infrastructure and accessibility barriers. Akande et al. (2025) stated that digitalization can create new exclusions when accessibility and universal design principles are not considered.

Secondly, the research examined teachers' interest in professional development towards differentiated digital instruction. The findings show that teachers exhibit a significantly high desire to learn in this area. This interest reflects a tendency to seek solutions to difficulties encountered in practice through professional learning. Besides, the demand for professional development indicates a trend towards using digital tools more harmoniously with pedagogical purposes.

Pongsakdi et al. (2021) stated that digital pedagogy training can positively influence teacher attitudes. Shi et al. (2025) reported that digital pedagogical professional development can strengthen teacher competence and self-efficacy. Khamzina et al. (2024) showed that the duration and presentation format of teacher training in inclusive education can have an impact on attitudes. Jiang et al. (2025) revealed that empathy and motivation in prospective teachers can be related to inclusive competence. Abiloye (2025) emphasized that digital literacy can function as an empowering resource for inclusive education. Omarsaib (2025) stated that institutional readiness can affect the sustainability of digital pedagogy.

The research also examined teachers' expectations regarding course content. The findings show that expectations are concentrated on identifying student characteristics and adapting to these differences. It is understood that teachers demand concrete examples of designing tasks and materials according to the difficulty level. In addition, the expectation of a systematic framework regarding content, process, and product differentiation stands out. The expectation regarding assessment and feedback processes suggests that assessment and evaluation adaptations are a critical area of need for teachers. Akande et al. (2025) emphasized that the fairness of digital assessment can be weakened when accessibility is not provided. Salsabila et al. (2025) reported that a significant relationship can be found between the digital competencies of EFL teachers and their level of transformation into pedagogical practice. Ding and Xue (2025) state that AI-based personalization and emotion recognition can affect participation.

The research examined the necessary support mechanisms to enhance the effectiveness of differentiated digital instruction. In this context, the findings indicate that teachers primarily need practical support such as methodological guidance, ready-made task banks, and lesson plans. This need suggests that reducing the planning burden is critical for the sustainability of the application. Furthermore, teachers consider structured professional support such as continuing education, workshops, and mentoring necessary. Shi et al. (2025) state that professional development can strengthen competence and self-efficacy. In addition, expectations for school administration support, time management, and institutional flexibility become prominent. Busri and Jamil (2025) emphasize that technology integration in inclusive programs is related to sustainable support mechanisms. Taga (2026) states that equity-based technology integration should be considered together with accessibility standards. Akande et al. (2025) showed that accessible design is as

crucial as the availability of technical resources. Omarsaib (2025) states that institutional readiness affects the continuity of digital applications. Woodcock et al. (2022) emphasized that teacher self-efficacy can be related to inclusive practices.

The research examined also the effect of differentiated digital instruction on student achievement. The findings showed that the achievement levels of the groups were similar before the intervention. After the intervention, it was understood that the achievement of students who received differentiated digital instruction was higher than that of their peers who received traditional instruction. This shows that digital differentiation can strengthen learning through input access and task adaptation mechanisms. Meşe and Mede (2023) reported that digital differentiation can support EFL success and self-regulation. Indriana et al. (2026) stated that technology integration can provide flexibility in ELT. Kakogianni et al. (2025) revealed that personalized and interactive digital experiences can support learning. Akande et al. (2025) emphasized that accessibility can indirectly contribute to learning opportunities. Nwachukwu et al. (2025) stated that adaptive systems can optimize learning by adjusting task difficulty and support level. Sun (2023) showed that differentiated L2 reading programs can support learning through flexibility. Chen and Shih (2025) reported that differentiation can be associated with success in self-regulated instructional designs.

Consequently, the research examined also the effect of differentiated digital instruction on student attitudes. The findings showed that the groups' attitudes towards English lessons were similar before the intervention. After the intervention, it was understood that students who received differentiated digital instruction developed more positive attitudes. This trend suggests that digital differentiation can produce a classroom climate that supports psychological safety and participation. Biju et al. (2024) showed in their study that digital assessment methods can produce different effects on anxiety, motivation, and attitude. Ding and Xue (2025) reported that AI-based personalization can affect affective processes. Chen and Shih (2025) stated that differentiation can support participation, motivation, and self-efficacy. Kakogianni et al. (2025) reported that multiple representation and instant feedback can increase participation. Akande et al. (2025) emphasized that digital personalization can produce exclusion when accessibility is not considered. In this context, it is thought that the positive change in attitude is related to the combined operation of accessibility and differentiation components.

### **Implications of the Findings**

The present research reinforces the need for design-based explanation at the intersection of inclusive education and digital pedagogy. The findings show that digitalization should be structured in a way that is compatible with accessibility and differentiation principles, rather than being tool-oriented. Akande et al. (2025) stated that a digital accessibility and UDL-focused approach is critical for inclusivity. At the theoretical level, the results suggest that differentiation is restructured in the digital environment in terms of content, process, and product dimensions. Väättäjä and Ruokamo (2021) stated that feedback loops and monitoring mechanisms are fundamental components of digital pedagogy. At the practical level, teacher demands indicate that in-service programs should be supported by case studies and task banks. Shi et al. (2025) reported that professional development can produce positive effects on competence and well-being. Ding and Xue (2025) emphasized that personalization practices should be considered in conjunction with ethical and pedagogical appropriateness. Busri and Jamil (2025) reported that institutional infrastructure and sustainable support mechanisms determine technology integration. In this context, the study produces practice-based contributions to teacher training, school governance, and accessibility standards.

### **Limitations**

The fact that the research was conducted within a specific country and region limits the generalizability of the findings. Designing the research with a focus on a single grade level restricts the comparison of effects across different age groups. The limited duration of the application makes long-term impact assessment difficult. The fact that the achievement test was developed by the researcher may limit the repeatability of the measurement tool in different contexts. The one-dimensional approach to the attitude scale restricts the detailed differentiation of the sub-components of attitude. The reliance of qualitative findings on interview data makes it difficult to completely exclude the effect of social desirability. The diversity in teachers' digital competence and differentiation experience levels may make it difficult to gather opinions on a common ground. These limitations necessitate a contextually sensitive and design-based evaluation of the results.

## **Recommendations**

Future studies are recommended to test differentiated digital instruction at different grade levels and school types. Extending implementation periods and evaluating persistence effects through monitoring measures are suggested. Structuring teacher professional development programs with task banks, sample lesson plans, and subject-specific scenarios is recommended. Developing school-level mentoring and coaching models and supporting teacher communities are recommended. Developing standards that prioritize accessibility and UDL (Universal Digital Learning) compatibility in digital tool selection is recommended. Disseminating application guides for designing accessible and equitable assessment and evaluation adaptations is recommended. Monitoring student participation across behavioral, cognitive, and affective dimensions and collecting multi-source data is recommended. Adding teacher training modules covering privacy, data security, and ethical dimensions to AI-based personalization applications is recommended. Developing time planning and resource allocation policies to strengthen school management support is recommended. Including student and family perspectives in the process and structuring an inclusive digital instruction ecosystem in a multi-stakeholder manner is recommended.

## **Conclusion**

This research reveals that differentiated digital instruction in inclusive English classrooms should be evaluated in conjunction with teacher experiences and student outcomes. The findings show that teachers face difficulties in managing student diversity due to time and resource constraints. However, it is understood that teachers show high interest in professional development and have expectations for application-oriented content. Teachers' support needs are concentrated in the dimensions of methodological guidance, material access, mentoring, and institutional preparedness. On the student side, differentiated digital instruction is seen to have a more positive impact on achievement and attitude towards the course. These results demonstrate that digitalization should be designed in a way that is consistent with inclusion goals. The study suggests that universal design and accessibility principles are fundamental components that make digital differentiation sustainable. Moreover, the research indicates that teacher competence and school ecology are contextual variables that determine the impact of implementation. In this regard, the study contributes to the need for evidence that addresses both the process and outcome

dimensions of digital differentiation in the context of inclusive English-language learning. Therefore, the results support the systematic structuring of accessible and differentiated digital instruction in teacher training and school policies.

### Funding

This research has been funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan IRN AP26102527 “Developing Differentiated Digital Educational Content for Teaching and Learning English in Inclusive Classrooms.

### References

- Abiloye, A. (2025). Empowering Pre-Service Teachers Through Digital Literacy for Inclusive Education. In *Empowering Pre-Service Teachers to Enhance Inclusive Education Through Technology* (pp. 1-18). IGI Global Scientific Publishing.
- Akande, F. O., Koranteng, U., Mensah, D., Mensah, T. K., & Awah, L. C. (2025). Technology-Supported Inclusive Education: A Systematic Review of Digital Accessibility and Universal Design for Learning. *Asian Journal of Current Research*, 10(4), 320-333. [10.56557/ajocr/2025/v10i49950](https://doi.org/10.56557/ajocr/2025/v10i49950)
- Alzahrani, F., Zamakhshari, N., & Elshemy, R. (2022). Did they manage to meet students' needs? English language instructors' experiences of remote instruction differentiation. *World Journal of English Language*, 12(7), 28. <https://doi.org/10.5430/wjel.v12n7p28>
- Beginbetova, G., Retnawati, H., Kassymova, G., Triyono, M., Azman, M., & Sodikin, R. (2025). Developing Students' HOTS Digital Literacy Profile by Using IRT. *Journal of Curriculum Studies Research*, 7(2), 155-176. <https://doi.org/10.46303/jcsr.2025.16>
- Biju, N., Abdelrasheed, N.S.G., Bakiyeva, K. *et al.* Which one? AI-assisted language assessment or paper format: an exploration of the impacts on foreign language anxiety, learning attitudes, motivation, and writing performance. *Lang Test Asia* 14, 45 (2024). <https://doi.org/10.1186/s40468-024-00322-z>
- Busri, A. A., & Jamil, H. (2025). Integration of Digital Technology in Inclusive Education Program: Challenges and Solutions. *Jurnal Pendidikan Bitara UPSI*, 18(Special Issue), 44-53. <https://doi.org/10.37134/bitara.vol18.sp.5.2025>
- Chen, C., & Shih, D. (2025). Facilitating EFL students' class engagement, motivation, self-efficacy, and achievements: Adopting differentiated instruction in self-regulated flipped

- learning. *Educational Technology Research and Development*, 73(5), 3201-3221. <https://doi.org/10.1007/s11423-025-10520-y>
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.
- Ding, Z., & Xue, W. (2025). Navigating anxiety in digital learning: How AI-driven personalization and emotion recognition shape EFL students' engagement. *Acta Psychologica*, 260, 105466. <https://doi.org/10.1016/j.actpsy.2025.105466>
- Griful-Freixenet, J., Struyven, K., Vantieghem, W., & Gheysens, E. (2020). Exploring the interrelationship between universal design for learning (UDL) and differentiated instruction (DI): A systematic review. *Educational Research Review*, 29, 100306. <https://doi.org/10.1016/j.edurev.2019.100306>
- Hamakali, H., & Josua, L. (2023). Engendering Technology-Assisted Pedagogy for Effective Instructional Strategy in the University of Namibia Language Centre. *Research in Educational Policy and Management*, 5(1), 18-32. <https://doi.org/10.46303/repam.2023.3>
- Hutson, J., & McGinley, C. (2023). Neuroaffirmative approaches to extended reality: Empowering individuals with autism spectrum condition through immersive learning environments. *International Journal of Technology in Education and Science*, 7(3), 400-414. <https://doi.org/10.46328/ijtes.499>
- Indriana, P., Susanto, D. A., Rahman, L. I., Susanti, S., Ridianto, R., Imandeka, E., ... & Wihastyanang, W. D. (2026). *Blended Learning and Technology Integration in English language Teaching (ELT)*. CV. Edu Akademi.
- Jiang, N., Li, H., Ju, S., Kong, L., & Li, J. (2025). Pre-service teachers' empathy and attitudes toward inclusive education—The chain mediating role of teaching motivation and inclusive education efficacy. *PloS One*, 20(4), e0321066. <https://doi.org/10.1371/journal.pone.0321066>
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), 112–133. <https://doi.org/10.1177/1558689806298224>
- Kakogianni, E., Petrou, A., Kasapidis, V., Konstantinidi, N. P., Kostalias, K., & Tarali, M. (2025). Integrating Digital Tools in Education: Enhancing Interactive and Personalized Learning Experiences. *European Journal of Education and Pedagogy*, 6(6), 121-132. <https://doi.org/10.24018/ejedu.2025.6.6.31022>
- Khamzina, K., Stanczak, A., Brasselet, C., Desombre, C., Legrain, C., Rossi, S., Guirimand, N., & Cilia, F. (2024). Designing effective pre-service teacher training in inclusive education: A narrative review of the effects of duration and content delivery mode on teachers' attitudes

- toward inclusive education. *Educational Psychology Review*, 36(1), 13. <https://doi.org/10.1007/s10648-024-09851-8>
- Krippendorff, K. (2018). *Content analysis: An introduction to its methodology* (4th ed.). SAGE Publications.
- Letzel, V., Pozas, M., & Schneider, C. (2023). Challenging but positive! – an exploration into teacher attitude profiles towards differentiated instruction (DI) in germany. *British Journal of Educational Psychology*, 93(1), 1-16. <https://doi.org/10.1111/bjep.12535>
- Magocha, M., Munyaradzi, J., & Babalola, S. S. (2025). The Impact of the Pandemic on Digital Literacy Skills for Online Teaching in Zimbabwean Schools: A Mixed-Methods Research Approach. *Research in Social Sciences and Technology*, 10(1), 310-331. <https://doi.org/10.46303/ressat.2025.17>
- Meşe, E., & Mede, E. (2023). Using digital differentiation to improve EFL achievement and self-regulation of tertiary learners: the Turkish context. *Innovation in Language Learning and Teaching*, 17(2), 340–353. <https://doi.org/10.1080/17501229.2022.2043872>
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE Publications.
- Msimango, W. N. (2025). Empowering Pre-Service Teachers to Enhance Inclusive Education Through Technology: Digital Pedagogy as a Catalyst for Empowering South African Pre-Service Teachers. *Empowering Pre-Service Teachers to Enhance Inclusive Education Through Technology*, 59-86.
- Nilholm, C. (2021). Research about inclusive education in 2020 - how can we improve our theories in order to change practice? *European Journal of Special Needs Education*, 36(3), 358-370. <https://doi.org/10.1080/08856257.2020.1754547>
- Nwachukwu, E. L., Egbue, N. G., & Victor-Nwakaku, I. (2025). Adaptive Learning Systems: Bridging Instructional Technology and Personalized Pedagogy through Design Thinking. *Journal of Digital Learning and Distance Education*, 4(5), 1689-1703. <https://doi.org/10.56778/jdlde.v4i5.588>
- Omarsaib, M. (2025). Integrating a digital pedagogy approach into online teaching: Are academic librarians at universities of technology in south africa prepared? *Information and Learning Science*, 126(3/4), 192-213. <https://doi.org/10.1108/ILS-01-2024-0012>
- Orakova, A., Nametkulova, F., Issayeva, G., Mukhambetzhanova, S., Galimzhanova, M., & Rezuanova, G. (2024). The Relationships between Pedagogical and Technological Competence and Digital Literacy Level of Teachers. *Journal of Curriculum Studies Research*, 6(1), 1-21. <https://doi.org/10.46303/jcsr.2024.2>

- Pongsakdi, N., Kortelainen, A., & Veermans, M. (2021). The impact of digital pedagogy training on in-service teachers' attitudes towards digital technologies. *Education and Information Technologies*, 26(5), 5041-5054. <https://doi.org/10.1007/s10639-021-10439-w>
- Rapp, A. C., & Corral-Granados, A. (2024). Understanding inclusive education - a theoretical contribution from system theory and the constructionist perspective. *International Journal of Inclusive Education*, 28(4), 423-439. <https://doi.org/10.1080/13603116.2021.1946725>
- Salsabila, F., Mirizon, S., & Vianty, M. (2025). An Empirical Investigation of EFL Teachers' Digital Competences and Its Pedagogical Application. *JOLLT Journal of Languages and Language Teaching*, 13(4), 1648-1663. <https://doi.org/10.33394/jollt.v13i4.14975>
- Shi, Y. R., Sin, K. F. K., & Wang, Y. Q. (2025). Teacher professional development of digital pedagogy for inclusive education in post-pandemic era: Effects on teacher competence, self-efficacy, and work well-being. *Teaching and Teacher Education*, 168, 105230. <https://doi.org/10.1016/j.tate.2025.105230>
- Sun, X. (2023). Differentiated instruction in L2 teaching: Two extensive reading programmes conducted during COVID-19 pandemic. *Innovation in Language Learning and Teaching*, 17(2), 177-190. <https://doi.org/10.1080/17501229.2021.1979985>
- Taga, J. R. (2026). *Inclusive Education in The Age Of Digital Transformation: An Integrative Review Of Equitable Technology Integration Practices*. *Sci.Int.(Lahore)*,38(1),15-18
- Tleubay, S., Nurzhanova, G., Mailybaeva, G., Utegulova, Z., Lim, V.S. & Yelubay, Y. (2025). Motivational, Cognitive, and Reflexive Components in the Development of Communicative Competence of Pre-Service Teachers in a Multilingual Education: An Experimental Study. *Journal of Social Studies Education Research*, 16(4), 58-85. <https://jsser.org/index.php/jsser/article/view/6708/754>
- Väätäjä, J. O., & Ruokamo, H. (2021). Conceptualizing dimensions and a model for digital pedagogy. *Journal of Pacific Rim Psychology*, 15 <https://doi.org/10.1177/1834490921995395>
- Wall Emerson, R. (2023). Mann-Whitney U test and t-test. *Journal of Visual Impairment & Blindness*, 117(1), 99-100. <https://doi.org/10.1177/0145482X221150592>
- Woodcock, S., Sharma, U., Subban, P., & Hitches, E. (2022). Teacher self-efficacy and inclusive education practices: Rethinking teachers' engagement with inclusive practices. *Teaching and Teacher Education*, 117, 103802. <https://doi.org/10.1016/j.tate.2022.103802>
- Yeleussiz, A. (2024). Exploring EFL Teachers' Perceptions of Media Literacy in Kazakhstan, *Journal of Social Studies Education Research*, 15(1), 282-316. <https://jsser.org/index.php/jsser/article/view/5682/664>

- Yuen, S. Y., Leung, C. C. Y., & Wan, S. W. (2022). Teachers' perceptions and practices of differentiated instruction: Cross-cultural validation of the differentiated instruction questionnaire in hong kong. *International Journal of Educational Research*, 115, 102044. <https://doi.org/10.1016/j.ijer.2022.102044>
- Zafeer, H. M. I., Maqbool, S., Rong, Y., & Maqbool, S. (2025). Impact of digital learning tools on student's engagement and achievement in middle school science classes. *International Journal of Technology in Education and Science*, 9(2), 177-196. <https://doi.org/10.46328/ijtes.622>