



Research Article

Beyond Curriculum Adoption: Generative Artificial Intelligence (GenAI), Puzzle-Based Instruction, and EFL Teachers' Pathways to Curriculum Innovation

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Abstract

The increasing complexity of language education has challenged traditional views of curriculum implementation and materials use in English as a Foreign Language (EFL) contexts. While published materials remain the primary instructional resource for many teachers, contemporary curriculum theory suggests that effective teaching extends beyond the mere adoption of prescribed content. This conceptual paper critically examines three major curriculum orientations—curriculum fidelity, adaptation, and enactment—and explores how EFL teachers negotiate the selection, modification, and development of instructional materials. Drawing on literature in curriculum studies, materials development, and language pedagogy, the paper positions Puzzle-Based Instruction (PBI) as a pedagogical framework that supports teachers in transforming curriculum a static body of content into a dynamic, learner-centered learning experience. Through processes of deconstruction, adaptation, recombination, and instructional redesign, PBI enhances teacher agency, learner engagement, personalization, and meaningful communication. The paper further argues that emerging technologies, particularly Generative Artificial Intelligence (GenAI), expand opportunities for curriculum innovation by enabling teachers to generate context-sensitive materials, communicative tasks, and adaptive learning activities. Rather than replacing teacher expertise, GenAI functions as a pedagogical partner that supports curriculum enactment and creative instructional design. The paper concludes that the integration of PBI and GenAI provides a promising pathway through which EFL teachers can move beyond curriculum adoption and adaptation toward sustainable curriculum innovation.

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1. Introduction

According to [Hutchinson and Waters \(1987\)](#) changes in recent years in the fields of applied linguistics and

language acquisition and in approaches to language teaching, have drastically changed the view of a one-size-fits-all approach to material development. The proficiency movement, the concept and various models of

communicative competence, the advent of ESP, the proliferation of methods of language teaching, and the diversification of the population of English learners, as mentioned by O'Malley Hadley (2003) have all provided teachers with many more options to considering deciding what should be the backbone of their course. Now the choices a course designer makes are much more context-based and so involve a number of factors such as who the learners are, their goals and expectations in learning English, the teacher's own conception of the nature of language and language learning and teaching (Hutchinson & Waters, 1987; Graves, 1996). A complementary perspective that can further illuminate the processes of curriculum adaptation and enactment is Puzzle-Based Instruction (PBI). Rooted in a constructivist view of learning, PBI conceptualizes language as a system of meaningful, combinable units ("puzzle pieces") that learners actively manipulate to construct understanding. In this sense, PBI aligns closely with the enactment approach to curriculum, where teachers are not mere implementers of prescribed materials, but active designers who reorganize, deconstruct, and reconstruct instructional content based on learners' needs and contextual demands.

In choosing, developing or adapting materials, a number of criteria are taken into account. Two of the most important of them are the 'effectiveness' of the materials in achieving the purpose of the course and their appropriateness for the students and teachers (Graves, 1996). Developing new materials and activities is time-consuming and difficult; therefore, it is not surprising that most teachers use published materials for their purpose. We usually embark on developing materials when there are no suitable materials for our purpose. It is usually very rare that teachers develop their own materials and do not use published materials. From a materials development perspective, Puzzle-Based Instruction offers a principled framework for both adaptation and creation of instructional units. Rather than relying solely on fixed texts or tasks, teachers break down linguistic input into functional and semantic components that can be flexibly recombined across contexts. This process enhances personalization, localization, and learner engagement—objectives already emphasized in the literature on material adaptation (Islam & Mares, 2003). In this way, PBI operationalizes adaptation not as superficial modification, but as a deeper restructuring of input to facilitate meaningful language use. Importantly, the integration of PBI shifts the focus from materials themselves to teachers' pedagogical decision-making.

Teachers working within a puzzle-based framework continuously evaluate which linguistic elements should be highlighted, sequenced, or recycled, thereby exercising a high degree of instructional agency. This resonates with the view that curriculum is "jointly created and experienced by teachers and learners" (Snyder et al.,

1992), reinforcing the idea that effective curriculum development emerges from dynamic interaction rather than rigid adherence to prescribed content.

Appropriateness of the materials usually refers to how comfortable and familiar the materials are for the students. Is the language level of the materials within the learners' achievable level? In other words, are the materials within zone of proximal development of the learners, following Vygotsky. Are the materials interesting and relevant? It should be mentioned that 'course book assessment is fundamentally a subjective rule-of-thumb activity, and that no neat formula, grid or system will ever provide a definite yardstick' (Gamlem et al., 2025; Sheldon, 1988, p. 245 in McDonough & Shaw, 2003, p. 61). Sometimes a text that looks to be appropriate will prove to be very difficult to implement as we introduce it to the class. One example of this situation is provided by Fujwara (1996). She describes a situation in which a text that seemed right in achieving the purpose of the course, developing listening skills and strategies, was in practice, too difficult for the students and therefore a text that looked to be appropriate proved to be inappropriate in practice. Therefore, texts will be selected subjectively, and their actual appropriateness will be a matter of actual practice. Furthermore, PBI strongly supports learner-centeredness by enabling students to actively construct language rather than passively consume it. As learners engage with puzzle pieces, they develop not only linguistic competence but also metacognitive awareness of how language works. This aligns with Tomlinson's (1995) emphasis on student-centered materials and the need for meaningful communication. Consequently, PBI can be seen as a practical realization of theoretical principles already discussed in the field, bridging the gap between abstract frameworks and classroom implementation.

The rapid expansion of online education has transformed how learners interact with content, teachers, and peers. While virtual learning environments provide unprecedented flexibility and accessibility, they also present challenges related to learner engagement, social interaction, motivation, and meaningful knowledge construction. Recent scholarship (e.g., Gao et al., 2025; Gaurina et al., 2025; Giannakos et al., 2025) has therefore called for pedagogical approaches that move beyond content transmission and promote active participation in digitally mediated learning contexts. From this perspective, Puzzle-Based Instruction (PBI) offers a valuable framework for understanding and enhancing virtual learning experiences.

Drawing on a phenomenological perspective of online education, PBI conceptualizes learning as an active process of meaning-making in which learners engage with linguistic and conceptual puzzle pieces to construct knowledge collaboratively (Manoochehrzadeh, 2025). Rather than positioning learners as passive recipients of

information, PBI encourages exploration, interaction, reflection, and problem-solving. Such characteristics are particularly important in online learning environments where learners may otherwise experience isolation, disengagement, or cognitive overload. Through the strategic organization of puzzle pieces, learners are encouraged to identify patterns, establish relationships among concepts, and actively participate in the construction of understanding.

From a curriculum perspective, the integration of PBI into virtual learning environments further strengthens curriculum enactment (Manoochehrzadeh, 2025). Teachers become designers of interactive learning experiences rather than transmitters of predetermined content. By decomposing instructional materials into manageable and meaningful units, teachers can create personalized learning pathways that accommodate diverse learner needs and promote greater autonomy. Furthermore, online technologies enable puzzle pieces to be presented through multimodal resources, collaborative tasks, discussion forums, interactive simulations, and digital storytelling activities, thereby enriching learner engagement and participation. The phenomenological approach to virtual learning emphasizes learners' lived experiences and perceptions of the learning process. Within this framework, PBI facilitates deeper engagement by encouraging learners to connect new knowledge with prior experiences and to actively negotiate meaning through interaction. Consequently, learning becomes a dynamic and socially constructed process rather than a passive consumption of digital content. This perspective aligns with social constructivist views of curriculum enactment and reinforces the argument that effective curriculum innovation emerges when teachers create opportunities for learners to actively participate in knowledge construction. The application of Puzzle-Based Instruction in online education therefore extends the concept of curriculum innovation beyond material adaptation toward the design of immersive, learner-centered, and collaborative virtual learning environments. As digital education continues to evolve, PBI offers a promising pedagogical framework for fostering engagement, autonomy, meaningful communication, and transformative learning experiences in both synchronous and asynchronous learning contexts.

1.1. Distinguishing Puzzle-Based Instruction from Existing Learner-Centered Approaches

Although Puzzle-Based Instruction (PBI) shares several assumptions with learner-centered, constructivist, and task-based approaches to language teaching, it introduces a distinctive pedagogical perspective that extends beyond these established frameworks. Similar to Constructivism, PBI views learning as an active process in which learners

construct knowledge through engagement and interaction. Likewise, it aligns with learner-centered pedagogy by emphasizing student participation, autonomy, and meaningful communication. Furthermore, PBI shares common ground with Task-Based Language Teaching (TBLT) in its focus on purposeful language use and problem-solving activities. However, PBI differs from these approaches in its conceptualization of language and instructional design. Whereas TBLT typically organizes learning around the completion of communicative tasks, PBI organizes learning around the identification, manipulation, deconstruction, and recombination of meaningful linguistic and conceptual "puzzle pieces." The primary focus is not merely task completion but the process through which learners recognize relationships among language elements and actively reconstruct meaning. In this sense, PBI provides teachers with a systematic framework for transforming curriculum content into flexible instructional units that can be adapted, reorganized, and personalized according to contextual needs. From a curriculum perspective, PBI also places greater emphasis on teacher agency and curriculum enactment. Teachers function not only as facilitators of learning but also as instructional designers who continuously select, deconstruct, adapt, and recombine curriculum components. This design-oriented process distinguishes PBI from many existing learner-centered approaches that primarily focus on learner activity while paying comparatively less attention to teachers' roles in curriculum innovation. Consequently, PBI contributes a unique bridge between curriculum theory, materials development, and classroom pedagogy by offering a practical mechanism through which curriculum adaptation can evolve into curriculum innovation. In the educational domain, GenAI has enabled a range of novel applications, including instructional content generation (Isaee et al., 2026; Li et al., 2024; Luo et al., 2026), automated assessment (Ferreira Mello et al., 2025), knowledge tracing (Moon et al., 2025), and instructional resource optimization (He-Yueya et al., 2024). The following table highlights key differences in instructional focus, learning organization, teacher roles, curriculum orientation, and material adaptation across Constructivism, Task-Based Language Teaching (TBLT), Learner-Centered Teaching, and Puzzle-Based Instruction, illustrating the unique contribution of PBI to curriculum enactment and innovation.

2. Conceptual Framework

To synthesize the theoretical foundations discussed above, Fig. 1 presents a conceptual framework illustrating how Puzzle-Based Instruction (PBI) facilitates the transformation of EFL teachers' curriculum practices from material adoption and adaptation toward curriculum

innovation. The framework integrates curriculum theory, instructional design, teacher agency, and learner-centered pedagogy to explain the process through which teachers become active curriculum designers and innovators.

Fig. 1 explains the conceptual framework of teachers' instructional design within PBI. The directional arrows represent a cyclical rather than linear process in which

teachers continuously move between curriculum adoption, adaptation, enactment, reflection, and innovation.

Feedback generated from instructional implementation informs subsequent material selection and redesign, creating an ongoing cycle of curriculum development.

Table 1. Conceptual and pedagogical distinctions between PBI and learner-centered approaches

Dimension	Constructivism	TBLT	Learner-Centered Teaching	Puzzle-Based Instruction
Primary Focus	Knowledge construction	Task completion	Learner needs	Puzzle-piece reconstruction
Unit of Learning	Concepts	Tasks	Learner experiences	Linguistic and conceptual puzzle pieces
Teacher Role	Facilitator	Task designer	Facilitator	Curriculum designer and innovator
Curriculum Orientation	Flexible	Task-oriented	Learner-oriented	Enactment and innovation oriented
Material Adaptation	Possible	Limited	Context-dependent	Central design principle

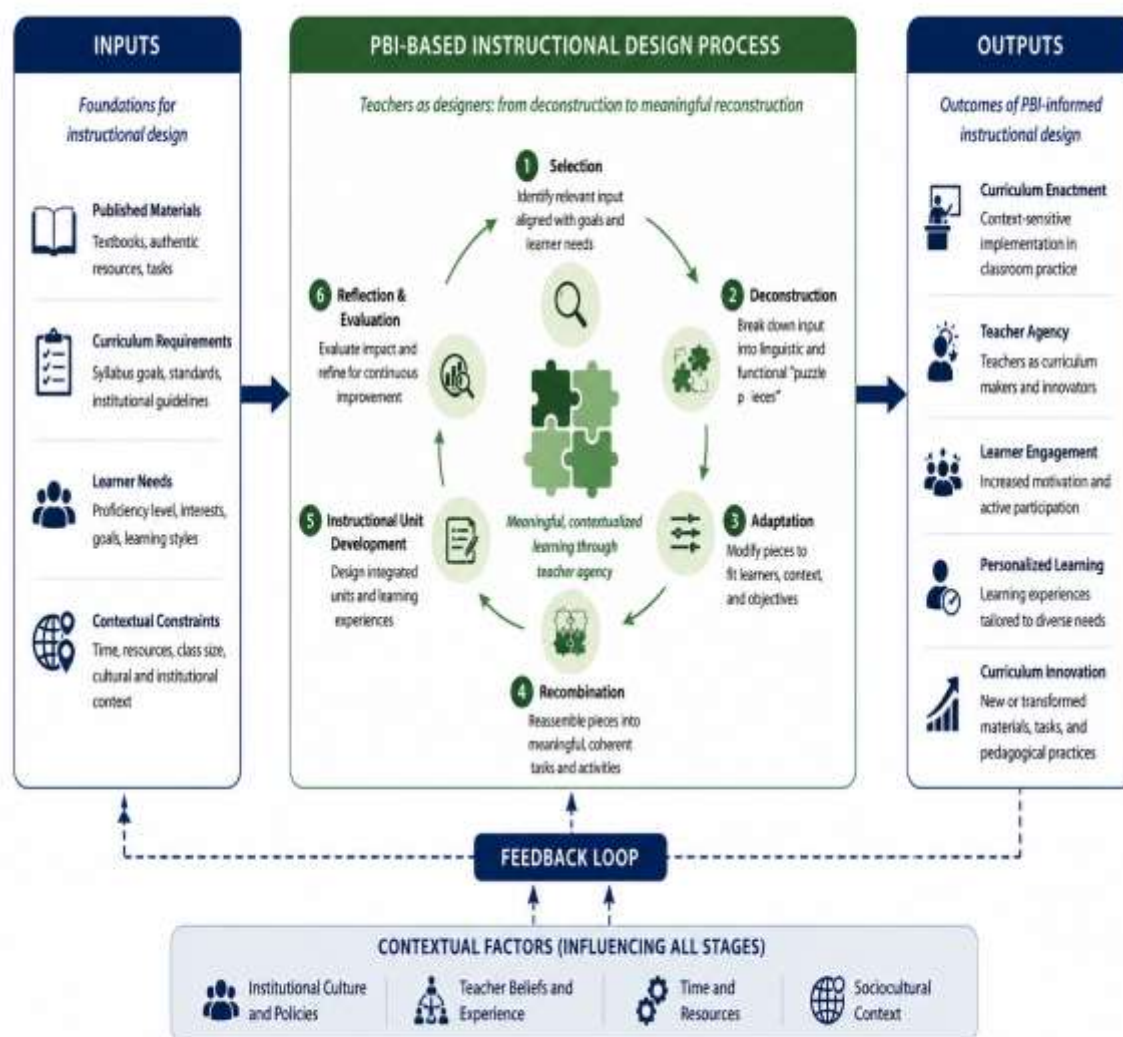


Figure 1. A conceptual framework of EFL teachers' instructional design practices within a Puzzle-Based Instruction (PBI) framework.

The conceptual framework of this paper positions PBI as a mediating pedagogical framework through which EFL teachers move from curriculum adoption and adaptation toward curriculum innovation. Traditional curriculum adoption often begins with the selection of published materials, textbooks, authentic resources, or syllabus-based content. However, the manuscript argues that teachers rarely use such materials without modification; rather, they adapt them according to learner needs, classroom realities, institutional requirements, and pedagogical objectives. Within this process, PBI provides a structured yet flexible approach by encouraging teachers to deconstruct linguistic input into meaningful “puzzle pieces” and then recombine these pieces into context-sensitive instructional units. This process transforms adaptation from a surface-level modification of materials into a deeper act of instructional design. Through selection, deconstruction, adaptation, recombination, instructional unit development, and reflection, teachers become active curriculum makers rather than passive implementers of prescribed content. Consequently, PBI strengthens teacher agency, learner engagement, personalization, and meaningful communication. The framework, therefore, suggests that curriculum innovation does not emerge merely from using new materials, but from teachers’ reflective and creative capacity to redesign existing resources into learner-centered, localized, and pedagogically effective learning experiences. Figure 1 indicates that published materials and curriculum requirements do not directly produce innovation; rather, curriculum innovation emerges when teachers engage in a Puzzle-Based Instruction design cycle that transforms selection, adaptation, and enactment into creative instructional unit development.

3. Principles of material design: Theoretical perspectives

Tomlinson (1995, p. 110) discusses the four theoretical principles for planning and writing of materials:

- *The need to communicate*
- *The need for long-term goals*
- *The need for authenticity*
- *The need for student-centeredness*

He also proposed two methods for materials development. One is a ‘text-driven’ method, and the other is a ‘task-driven’ method. Tomlinson (1995) mentioned that the ‘text-driven’ method is ideal for developing course books and supplementary classroom materials, and the ‘task-driven’ method is ideal for localizing and personalizing classroom materials, for autonomous learning. In the text-driven method, he refers in detail to some procedures from ‘text-collection’, ‘text selection’, ‘text-experience’, etc. Tomlinson (1995) believes that using such a framework as a guide, one can very quickly

develop principles and engaging materials either for a particular class or for a particular course. In the ‘task-driven’ method, the focus is on tasks. Tasks are activities in which learners need to use language to produce something. Prabhu (1987) defines as task as an activity that requires learners to arrive at an outcome from given information through some process of thought (p.24). Tasks may be either real-world or pedagogic ones. Tomlinson (2003, p. 109), in developing principled frameworks for material development, cites a number of authors. For example, he mentions the six principles of material design identified by Nunan (1988):

- *Materials should be clearly linked to the curriculum they serve.*
- *Materials should be authentic in terms of text and task*
- *Materials should stimulate interaction*
- *Materials should encourage learners to focus on formal aspects of the language*
- *Materials should encourage learners to develop skills, and skills in learning*
- *Materials should encourage learners to apply their developing skills to the world beyond the classroom*

3.1. Curriculum adaptation/adoption

Snyder et al. (1992, p. 410) cite the mutual-adaptation approach is a “process whereby adjustments in a curriculum are made by curriculum developers and those who use it in the school or classroom context”. This involves conversations between teachers and external developers for introducing adaptations necessary to match the curriculum to local contexts. The adaptation approach does not suggest that curriculum knowledge should differ considerably from the fidelity approach, since experts still define it.

The adaptation approach has stimulated interactions between teachers, students and curriculum. Whether it is called teacher curriculum development (Ben-Peretz, 1990), teacher instructional capacity (Cohen & Ball, 1999), or the experienced curriculum (Doyle, 1992), using this approach enfranchises teachers to shape curriculum according to their contexts. However, it is the enactment approach that hands curriculum to teachers (Snyder et al., 1992). Graves (1996) points out that teachers consider a variety of factors in developing, choosing, or adapting materials. Two of the most important are their effectiveness in achieving the purpose of the course and their appropriateness for the students and the teacher. She emphasizes that appropriateness includes student comfort and familiarity with the material, language level, interest, and relevance. Some teachers incorporate instruction in how to use unfamiliar materials as part of their course design.

Graves (1996) contends that developing new materials and activities for using them requires time and a clear sense of why they will be used, how, and by whom. Because of the lack of time, teachers are often constrained or prefer to adapt existing materials.

We adapt materials for different reasons. McDonough and Shaw (1993), citing Madsen and Bowen (1978) mention that materials are adapted in order to achieve 'congruence'. They further discuss that a good teacher is constantly striving for congruence among several related variables: teaching materials, methodology, students, course objectives, the target language and its context, and the teacher's own personality and teaching styles. McDonough and Shaw's list of reasons for adaptation reflects their concern that communicative language teaching implies an unsystematic approach to grammar presentation, and they believe that they need to approach grammar systematically. Cunningsworth (1995) also lists a number of factors for adaptation of materials:

- a. *The dynamic of the classroom*
- b. *The personalities involved*
- c. *The constraints imposed by syllabuses*
- d. *The availability of resources*
- e. *The expectation and motivations of the learners*

Adoption of the material is the process of choosing and selecting materials. Rarely do we adopt materials without any modification. So, the process of adaptation and adoption has blurred boundaries. As McDonough & Shaw (2003) state, 'adaptation is linked to issues of administration and the whole management of education, is so far as it derives from decisions taken about material to be adopted' (P.85). Published course books, which are written by experienced and qualified people, contain valuable materials for the teachers. The reason is their contents are usually carefully tested in pilot studies in actual teaching situations before publication. Therefore, teachers can select their materials from such course books with a degree of confidence. Despite these, however, Cunningsworth (1984; 1995) warns the teachers that course books are good servants but poor masters. By this, he means teachers should use the course books actively. That is, they should formulate objectives with the needs of the learners in mind and then seek out published material that will achieve those objectives. In other words, should not set the objectives for the teachers. He further goes on to discuss that those teachers who set their objectives in terms of finishing chapter x and y of such and such course books are in fact slaves of the book or what he terms 'servants of the course book rather than master' (Cunningsworth, 1984, p.1).

There is a plethora of teaching materials in the market today. The teachers must select from among this mass of teaching materials. The question is what the criteria should be for the selection of teaching materials. Apart from those rule-of-thumb criteria cited at the beginning of this

assignment, which included effectiveness of teaching materials and appropriateness of them for the learners, Cunningsworth (1984; 1995) outlines a number of principles for material evaluations:

- a. Relate the teaching materials to [one's] aims and objectives

In other words, once we select the teaching materials, we need to keep in mind that the materials used should take the learners forward as directly as possible towards the already set and determined objectives.

- b. Be aware of what language is for and select teaching materials which will help equip your students to use language effectively for their purpose

Nation and Macalister (2010, p. 162) listed six items a teacher can do to adapt a course book.

1. *Add or omit content:* The teacher adds exercises to give extra practice to items that are frequently used in the language or which require extra time to learn. The teacher skips over confusing or unimportant parts of a lesson.
2. *Change the sequencing of the content:* The teacher introduces some items earlier in the course because they are needed to do added activities.
3. *Change the format:* Instead of beginning the lesson with a dialogue, the teacher puts it towards the end of the lesson and uses the other exercises in the lesson to prepare for it.
4. *Change the presentation:* The teacher uses different techniques than those used in the book. Add or omit monitoring.
5. The teacher encourages the learners to make tests to check each other's learning of what is in the lesson
6. *Add or omit assessment.* The teacher introduces weekly tests to encourage learners to do homework or to let them see their progress.

Nation and Macalister (2010, p. 163) further suggested teachers to use more than one single course book. Their reasons have been listed below:

1. a single course book does not meet the diverse needs of the learners in the class.
2. Drawing material from a variety of sources allows the teacher to keep each lesson as close as possible to what the learners need. The teacher must provide meaningful, authentic activities to help students construct understanding relevant to problem solving
3. Learners can have a strong say in what kind of topics and what kind of material they work with. Students are active learners. The educator's task is to provide students with opportunities to construct knowledge
4. Teachers have the chance to make greater use of their professional skills, such as material

preparation, course planning, adaptation of activities, and multi-level teaching in one class.

5. The circumstances under which the course is taught make it difficult to find an appropriate textbook.
6. Current course books do not reflect “state of the art” knowledge in Applied Linguistics

Islam and Mares (2003) believe that for any adoption or adaptation of materials, we need to have clear adaptation objectives. Referring to McDonough and Shaw’s list of objectives in order to achieve the appropriateness criterion, the materials should be adopted to: personalize, individualize, localize, and modernize. Islam and Mares expand the list to include: add real choice, cater for all sensory learner styles, provide for more learner autonomy, encourage higher-level cognitive skills, make the language input more accessible, and make the language input more engaging. Adaptation of existing materials is the result of recognizing a mismatch between the teaching materials and the needs and objectives of the classroom. A list of techniques has been offered by the scholars to be used when adapting materials. These techniques are: adding, extending, and expanding, deleting, subtracting, and abridging, simplifying, recording, and replacing materials (McDonough and Shaw, 1993; Cunningsworth, 1995).

Classroom materials need to be adapted in a principled manner to reflect needs within particular teaching contexts, current understanding of second language acquisition and good teaching practices. Selection of materials without the above-mentioned consideration may lead to failure. They emphasized that changes in existing programs should take place only after a careful study of the instructional plans currently in effect. The program designers should utilize whatever information can be collected and they should always be ready to make shifts and adjustments if new information becomes available. Nunan (1988 a) argues that materials should be designed so that they are capable of being used in a variety of ways and also at different proficiency levels. He continues that the authenticity of the materials has aroused a great deal of debate. Those who take a hard line on authenticity insist that these should not be edited in any way.

3.2. Curriculum fidelity (curriculum transmission)

This approach reflects Tyler’s (1949) classical model that specified objectives, content, and means of achieving and assessing pre-determined learning outcomes. Curriculum change follows a top-down strategy of materials development and diffusion (Kelly, 1999). Despite maintaining equal opportunity and standards (Gordon, 1981), a top-down curriculum is focused on organizational rather than local needs (Brady, 1995), and fails to encourage teacher development and active learning

(Craig, 2006; Fishman, Marx, Best, & Tal, 2003; Knowles, 1999). Snyder et al. (1992, p. 427) postulate that the fidelity approach confines curriculum to “a course of study, a textbook series, a guide [and] a set of teacher plans”. This involves implications for curriculum knowledge, curriculum change, and the teacher’s role. External experts define curriculum knowledge by determining what teachers should teach. Curriculum change, subsequently, starts from the centre to the periphery in linear and systematic stages, leaving no role for teachers apart from delivery (Snyder et al., 1992). Therefore, teachers are transmitters who follow classical humanism aimed at delivering static information, continuity between the past and present, and simplistic standards of achievement (Clark, 1987; Skilbeck, 1982).

3.3. Curriculum enactment (curriculum making)

The enactment approach reflects social constructivism, involving active learning, social and sequential construction of more complex cognitive schemas, and student interests and needs (Richardson, 1997; Terwel, 2005). According to Snyder et al. (1992, p. 428), the enactment approach sets curriculum as a process “jointly created and jointly and individually experienced by students and teachers.” Curriculum- knowledge is no longer a product, but ongoing constructions out of “the enacted experiences. [that] students and teachers create” (1992, p. 410). External knowledge is “viewed as a resource for teachers who create curriculum as they engage in the ongoing process of teaching and learning in the classroom.” Moreover, “it is they and their students who create the enacted curriculum. Teachers are creators rather than primarily receivers of curriculum knowledge.” Curriculum change is neither about curriculum implementation nor adaptation. It is “a process of growth for teachers and students, a change in thinking and practice” (Snyder et al., 1992, p. 429).

3.4. Generative Artificial Intelligence and Curriculum Innovation in EFL Education

The emergence of Generative Artificial Intelligence (GenAI) has introduced new possibilities for curriculum innovation, instructional design, and material development in language education. Artificial intelligence is rapidly transforming educational practices, particularly in English language teaching (Isaee & Barjesteh, 2026). Unlike traditional digital tools, AI systems such as large language models, automated writing evaluators, and adaptive learning platforms offer interactive, personalized, and responsive support for both teachers and learners. Unlike traditional educational technologies that primarily deliver pre-existing content, GenAI systems can generate text, exercises, feedback, lesson plans,

simulations, and learning activities in response to user prompts. Consequently, teachers are no longer limited to selecting or adapting published materials; they can actively collaborate with AI tools to design personalized, context-sensitive, and learner-centered instructional experiences.

From a curriculum perspective, GenAI aligns closely with contemporary views of curriculum enactment, which emphasize teachers' active role in creating and transforming curriculum rather than merely implementing externally prescribed content. By assisting teachers in generating examples, communicative tasks, assessment activities, and differentiated learning materials, GenAI expands opportunities for curriculum adaptation and instructional innovation. This is particularly relevant in English as a Foreign Language (EFL) contexts, where teachers often face challenges related to diverse learner needs, limited resources, and the need for contextualized materials.

The integration of GenAI also complements the principles of Puzzle-Based Instruction (PBI). Within a puzzle-based framework, language is viewed as a system of meaningful and combinable units that can be manipulated and reorganized to facilitate learning. GenAI can support this process by generating multiple examples of linguistic puzzle pieces, creating contextualized practice activities, and assisting teachers in designing instructional units that promote meaningful communication and learner engagement. Rather than replacing teachers, AI functions as a pedagogical partner that enhances teacher agency and creativity in curriculum design.

Recent studies (e.g., Lee et al., 2025; Koç & Savaş, 2025; Mahmoudi-Dehaki & Nasr-Esfahani, 2025) have highlighted the potential of GenAI to support teacher professional development and instructional innovation. For example, Kasneci et al. (2023) argue that large language models can serve as powerful educational tools capable of supporting teaching, learning, and assessment when used responsibly. Similarly, Tlili et al. (2023) suggest that ChatGPT and related AI systems offer unprecedented opportunities for personalized learning and content generation while simultaneously requiring careful pedagogical and ethical consideration. Research on AI-supported instructional design further indicates that teachers can use GenAI to create adaptive learning environments that respond to students' interests, proficiency levels, and learning goals.

Despite these opportunities, the integration of GenAI into language education also presents challenges. Concerns regarding accuracy, bias, academic integrity, data privacy, and overreliance on automated systems highlight the continued importance of teacher judgment and pedagogical expertise. Therefore, the effective use of GenAI should be guided by educational objectives, learner

needs, and sound pedagogical principles rather than technological novelty alone. Overall, the convergence of Puzzle-Based Instruction and Generative Artificial Intelligence represents a promising direction for EFL education. Together, they provide a framework through which teachers can move beyond curriculum adoption and adaptation toward curriculum innovation, creating more personalized, engaging, and contextually relevant learning experiences.

3.5. Emerging Directions: Puzzle-Based Instruction and Generative AI

Recent developments in Generative Artificial Intelligence (GenAI) have further expanded opportunities for curriculum innovation and instructional design in language education (Koç & Savaş, 2025). Emerging research on pre-service EFL teachers' adoption of GenAI-powered game-based instruction suggests that AI technologies can support teachers in designing personalized, engaging, and context-sensitive learning experiences. Rather than merely consuming pre-designed materials, teachers increasingly act as instructional designers who collaborate with AI tools to generate activities, adapt content, create authentic communicative tasks, and develop learner-centered instructional units. This shift resonates strongly with the principles of Puzzle-Based Instruction (PBI), which conceptualizes language learning as the active manipulation and recombination of meaningful linguistic units. Within a PBI framework, GenAI can assist teachers in identifying, organizing, and contextualizing language puzzle pieces while simultaneously generating adaptive learning activities tailored to students' proficiency levels, interests, and learning needs. Consequently, the integration of GenAI reinforces teacher agency by enabling educators to move beyond curriculum adoption and adaptation toward curriculum innovation. In this sense, AI functions not as a replacement for teacher expertise but as a pedagogical partner that supports curriculum enactment, creative material development, and the design of meaningful learning experiences. The convergence of PBI and GenAI therefore represents a promising direction for future language education, where human pedagogical judgment and technological affordances jointly contribute to innovative curriculum design and learner engagement.

3.6. Challenges and Ethical Considerations in Using GenAI for Language Education

While Generative Artificial Intelligence offers significant opportunities for curriculum innovation, its integration into language education also requires careful and balanced consideration of potential challenges. One major concern is the possibility of AI hallucinations, where generated

content may appear accurate but contain factual, linguistic, or pedagogical inaccuracies. In EFL contexts, this can be particularly problematic because learners may accept incorrect language examples, explanations, or cultural information without sufficient critical evaluation. Therefore, AI-generated materials should not be used without teacher review, contextual adaptation, and pedagogical validation.

Another important challenge relates to bias. Since GenAI systems are trained on large datasets, they may reproduce cultural, linguistic, gender-based, or ideological biases present in those data. In language education, such bias may influence the selection of examples, representations of cultures, classroom scenarios, or communicative norms. Teachers should therefore critically examine AI-generated content to ensure that it is inclusive, culturally appropriate, and suitable for learners' backgrounds and educational contexts. Data privacy is also a central ethical concern. Teachers and learners may unintentionally share personal information, classroom data, assessment results, or learner-produced texts with AI tools. This raises questions about confidentiality, consent, institutional policy, and responsible data use. For this reason, the use of GenAI in EFL education should be guided by clear ethical principles, including the protection of learner identity, avoidance of sensitive personal data, and compliance with institutional and national data-protection regulations. A further concern is teacher dependence on AI-generated content.

Although GenAI can support material development, lesson planning, and activity design, excessive reliance on AI may weaken teachers' professional judgment, creativity, and curriculum-making capacity. Within a Puzzle-Based Instruction framework, AI should therefore be understood as a pedagogical assistant rather than a substitute for teacher expertise. Teachers remain responsible for selecting, deconstructing, adapting, recombining, and evaluating instructional materials according to learners' needs and classroom realities. Overall, the effective use of GenAI in language education depends on maintaining a balance between technological affordances and human pedagogical responsibility. Ethical integration requires teacher oversight, critical AI literacy, transparent use, protection of learner data, and continuous evaluation of AI-generated materials. In this regard, GenAI can contribute to curriculum innovation only when it is embedded within reflective, responsible, and context-sensitive teaching practices.

4. Conclusion

Concern has been expressed that students learn better in some classrooms, whereas in other classrooms, they underachieve despite using one curriculum. It is equally concerning that some teachers continue to develop, while

others do little to advance their professional skills in spite of teaching the same curriculum. Moreover, we need to understand how different curricula result from implementing a single curriculum. Teacher curriculum approaches may address these concerns because they may influence teachers, students and curriculum alike; thereby, turning the learned curriculum into a curriculum that is substantially different from the formal curriculum. According to Dubin and Olshtain (1986), a teacher in selecting a material and deciding the adopting or adapting that material should take into account the following questions:

- By whom and where were the materials developed?
- Are the materials compatible with the syllabus?
- Do most of the materials provide alternatives for teachers and learners?
- Which language skills do the materials cover?
- How authentic are the text types included in the materials?
- How do learners and teachers who have used the materials feel about them?

Authors' Contribution

All the authors have participated sufficiently in the intellectual content, conception, and design of this work or the analysis and interpretation of the data (when applicable), as well as the writing of the manuscript.

Availability of data and materials

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

Conflict of interest

The author states that there is no conflict of interest.

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