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Abstract: This paper interprets the theories of Vygotsky through the lenses of creativity in education and learning design using technology. It is important to address the role of the teacher in today's technology-enhanced classrooms. This initiative has not been addressed, and it may lead to new ways of thinking about creativity in today's teaching profession. Teachers' roles have shifted from instructors to designers of effective scenarios for technology-enhanced learning. In this context, teachers need to be able to creatively connect pedagogy, content, and technology in learning design. The work of Vygotsky emphasizes the role of the teacher when assessing the learner's developmental level, by tailoring the teaching so that it falls within the zone of proximal development. The procedure leads to new knowledge, indicating a creative process. Language as a tool now has new means to be transmitted—new technologies. Considering these connections, questions need to be re-addressed: What is the connection between creativity and the zone of proximal development? How has the learning design field shifted the role of the teacher and how does this relate to (1) the theory of cognitive development from a constructivist perspective and (2) the theory of the zone of proximal development? What are the connections between the new role of the teacher as a designer with creativity and technology in the zone of proximal development? In this paper, we synthesize the knowledge between creativity in learning design using technology and Vygotsky's theories, concluding with an interpretation of how the teacher can be assisted by his theories and synchronous technologies in creative learning design.



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1. Introduction to Creativity in Education According to Vygotsky's Zone of Proximal Development

Creativity is one of the most essential qualities of thinking, bringing social, emotional, cognitive, and professional benefits. Creativity in education has been a constant theme of interest among researchers for the past fifty years. It is associated with the well-being of individuals (Acar et al., 2021) and with positive academic performance (Tzachrista et al., 2023). Creativity is recognized as an innovative human potential in all major academic disciplines. Creativity is something that can be nurtured and should be studied in an interdisciplinary way according to scholars (Aguilera & Ortiz-Revilla, 2021). Teachers are responsible for enhancing creativity and creative thinking in their students. However, the role of teachers in contemporary classrooms has evolved from mere curriculum deliverers to architects of effective learning experiences tailored to a learner-centered technology-enhanced learning (TEL) environment. Technology integration expert educators use tools

to foster creativity by sparking curiosity, supporting idea development, producing digital outputs, structuring creative processes, enhancing creative teamwork, and evaluating student outcomes through assessment techniques. They understand academic research and employ various strategies to cultivate creativity in their teaching methods (Bereczki & Kárpáti, 2021). Learning design (LD) is the field in which these new strategies using technology and content take place. Craft and Mor define learning design as ‘the creative and deliberate act of devising new practices, plans of activity, resources, and tools aimed at achieving particular educational aims in a given context’ (Perna & Nunziante, 2021, p. 480). In this definition of learning design, resources like technology tools are quite important, yet teachers still struggle to incorporate them, because most tools are not designed for pedagogical purposes. Teachers frequently encounter difficulties in accessing necessary technology, inadequate professional development, and managing their attitudes toward technology (Gomez et al., 2022). Educators often need extra assistance and cooperation from their schools to successfully incorporate technology. Institutions often lack the necessary strategies and vision for technology integration (Xie et al., 2023). Technology-enhanced learning (TEL) frameworks tried to answer the question of how technology is integrated into the learning process. A widely accepted framework for technology integration is technological pedagogical content knowledge (TPACK) (Mishra et al., 2023). TPACK seeks to improve teachers’ integration of technology by combining three types of knowledge. Firstly, content knowledge (CK), which involves understanding the subject matter. Secondly, pedagogical knowledge (PK), which pertains to methods and practices of teaching. Lastly, technological knowledge (TK), is about understanding how to use technological tools and resources. The framework emphasizes the dynamic interplay between these forms of knowledge and highlights the importance of technological support (Brianza et al., 2022). TPACK speaks of creative practices when designing the content, the pedagogy, and the technology of a lesson plan (Tseng et al., 2022). Thus, creativity in learning design using technology is important for every teacher to develop innovative lesson plans. Reflecting on teaching and design decisions allows teachers to better integrate technology with pedagogy and content, enhancing their overall effectiveness (Jiménez Sierra et al., 2023). Creativity and technology are indispensable skills in 21st-century education that all teachers should develop (Dilekçi & Karatay, 2023). The role of the teacher needs to be upgraded within these components to be in line with contemporary education. Following these lines, we are directed towards the eminent theories of Vygotsky about the teacher.

This paper explores the relationship between Vygotsky’s sociocultural theory of cognitive development (Tzuriel & Tzuriel, 2021) and creativity in learning design using technology. What interpretation can be made? How has the learning design field shifted the role of the teacher and how does this relate to (1) the theory of cognitive development from a constructivist perspective and (2) the theory of the zone of proximal development (ZPD)? What are the connections between the new role of the teacher as a designer with creativity and technology in the ZPD? Vygotsky’s theories have gained prominence, particularly his emphasis on the teacher’s role within the zone of proximal development (Alkhudiry, 2022). We tried to connect this theory with creativity in education. Creativity frameworks like the four Ps emphasize (Gong et al., 2022) four components when studying creativity: the person, the process, the product, and the press. The theory speaks about the interactions of the learner (process, person) and the social environment (press) for creating a product that is assessed by society as being novel and effective. Additionally, the systems model by Csikszentmihalyi (Atkinson & Barker, 2023) speaks of a systemic approach when addressing creativity: the individual, the domain, and the field. These theories aligned with the ZPD help us understand how creativity occurs within the teacher and the student interaction. The collaboration between teacher and learner bridges the gap

between the individual and society, facilitating the development of a creative product—new knowledge. Additionally, in learning design that uses technology, we see the connection between Vygotsky’s influential theory regarding language. In Vygotsky’s view, language is not only a tool for communication and collaboration but also a fundamental means of thought and cognitive development (McLeod, 2024). This aligns with the notion that learning designs should be reusable and shareable, necessitating a ‘common’ language that is easily understood by practitioners. Technology aids communication between the teacher and the learner, transmitting the sociocultural environment. In parallel, it helps in the enhancement of learning, leading to cognitive development and new knowledge, as it provides new instruments for transmission that enhance and make the process easier. For example, as a result of emerging digital technologies, activities such as remembering information and solving problems are now frequently handled by digital devices, which effectively expands our cognitive functions into digital space. This change poses a challenge to the conventional role of educators, as students increasingly depend on digital tools for cognitive tasks that used to be guided by interactions with teachers. As a result, teachers need to adjust by incorporating these technologies into their instructional methods to successfully foster cognitive growth in the digital era (Falikman, 2021). As concluded above, this review aims to establish a link between Vygotsky’s prominent theories and the teacher as a learning designer. This will help us in our quest for a creative teacher/learning designer. Teachers need to have the necessary creative skills to design new lesson plans or curricula using technology. Teachers need to be creative in their practices. Creativity in learning design signifies the creation of high-quality and effective educational artifacts, and the initiative is important because the creativity and effectiveness of teachers significantly impact both student outcomes and professional development (Dogbe et al., 2024). Based on these theoretical foundations, the following research questions have been addressed:

1. RQ1: What is the connection between creativity and the zone of proximal development?
2. RQ2: How has the learning design field shifted the role of the teacher and how does this relate to (1) the theory of cognitive development from a constructivist perspective and (2) the theory of the zone of proximal development (ZPD)?
3. RQ3: What are the connections between the new role of the teacher as a designer with creativity and technology in the ZPD?

We conclude that Vygotskian theories are highly connected to creativity in education and learning design, pointing to a new teacher. The teacher as a learning designer is creative in their practice, utilizing technology, content, and pedagogy in novel and effective ways. The outcome is a creative learning design or lesson plan that uses technology and that helps foster creativity in the classroom and eventually creativity in students, as research has shown that it is linked to student outcomes and overall engagement in learning.

The structure of the paper is as follows: In Section 2, we analyze creativity in education, highlighting definitions and frameworks. We focus on the importance of the teacher’s role and the connection between creativity in the teacher and the zone of proximal development. In Section 3, we will make connections between creativity and Vygotsky’s life to understand how he was a scholar who was indeed very creative. In Section 4, we discuss creativity in teachers’ education. In Section 5, we analyze how creativity is related to technology-enhanced learning design. In Section 6, we make the connections between technology-enhanced learning design, Language and the Zone of Proximal Development. This connection helps us understand the new circumstances in which his work can be viewed. In the last chapter, we conclude/propose a new role of creative teacher/learning designer with the help of the human–machine pair inspection (HMPI) methodology. Human-machine pair inspection merges the advantages of human knowl-

edge and machine productivity to improve inspection procedures in multiple sectors. In learning design, AI, learning analytics (LA), and learning design (LD) tools could assist in the creation of technology-enhanced scenarios intervening in the process and verifying that the steps are correct. By combining human creativity with machine data and precision, human-machine collaborative inspection systems could enhance the effectiveness of learning design using technology (Chen, 2022). In the last chapter, we draw our conclusions, answering research questions. The findings suggest that interpreting creative learning design using technology and Vygotsky's theories can result in enhancing the role of the teacher when creating learning scenarios for technology-enhanced classrooms. Future research on our interpretation will result in further establishing our hypothesis.

2. Creativity in Education and the Zone of Proximal Development

In this chapter, we will make a connection between creativity in education and the zone of proximal development. These concepts are connected as educators engage in dialogic mediation which fosters and impacts advanced cognitive growth encompassing creativity. We will analyze creativity in education in general and then emphasize important frameworks. This analysis will contribute to seeing the connections in correlation not only with cognitive development but also with the zone of proximal development.

Historically speaking, Guilford established creativity in education research during the mid-20th century. Since then, there has been an increased interest that experienced explosive growth around 2000. The fields of educational sciences and parts of psychology have created knowledge that informs the relatively interdisciplinary research on creativity in education. In 1980–1990, there was a focus in the social-psychological approach which eventually led to a more systematic study of creativity in common people, in what we call 'everyday' creativity. This has led to an organized scientific focus on educational contexts (Hernández-Torrano & Ibrayeva, 2020).

The setting of the creativity frame addresses several important topics when studying creativity in education. A recent bibliometric map has outlined the subsequent overarching themes within the field of education over the last 45 years: (a) the instruction and acquisition of creativity, (b) the psychological and educational relationships associated with creativity, (c) the influence of creativity within organizations, and (d) the cognitive and emotional processes that affect creativity (De-Marchis & Shchebetenko, 2024). Important research initiatives are conducted in definitions and theoretical frameworks for creativity. Teacher professional development and creativity in teaching and learning are emerging fields of inquiry. Lastly, creativity and technology studies primarily seek to investigate the underpinnings of creativity, assess the impact of educational policies on the implementation of technology to foster creativity across various nations and highlight the crucial importance of technology in enhancing creativity within 21st-century education (Li et al., 2022). In the realm of education, most research on creativity concentrates on identifying talented and gifted students as well as components of student creative behavior or assessment of divergent thinking or creative problem-solving (Katz-Buonincontro & Anderson, 2020).

Creativity is related to higher-order cognitive skills and requires effort to be achieved. Creativity is often linked to the highest level of cognitive processes in Bloom's framework, particularly in the revised taxonomy introduced in 2001 (Chandio et al., 2021). Guilford emphasized two processes leading to creativity: divergent and convergent thinking. Divergent thinking is the process of generating ideas or solutions to solve a problem and convergent thinking is when various thoughts from life experiences are organized in a connected way to fix a particular issue (Eon Duval et al., 2023). Divergent thinking is important in creativity development. Torrance (Ivancovsky et al., 2021) distinguished four

lines in the creativity assessment of divergent thinking: fluency, flexibility, originality, and elaboration of creative ideas:

- a. Fluency is the ability to produce many different ideas.
- b. Flexibility is the ability to produce multiple ideas from a wide pool of ideas.
- c. Originality is the ability to produce ideas that are different from the usual.
- d. Elaboration is the ability to produce detailed ideas.

Creativity is a multifaceted phenomenon that can be approached from different angles. For this purpose, different frameworks have been developed to assist in the study of creativity. Rhodes, in 1961, was the first to create a comprehensive framework for creativity. In his four Ps framework, we see the following components of creativity: the person who has the characteristics to be creative; the press, meaning the social and cultural environment that fosters or hinders creativity; the product, meaning the creative artifact; and the process, which speaks of the creative thinking and the mental function that happen when we are creative (Yeung & Bautista, 2024). Another important framework is the five As. Glăveanu emphasizes the following components when creative action occurs:

- a. actors,
- b. actions,
- c. artifact,
- d. audience, and
- e. affordance.

These five aspects all contribute to the creative process. For example, creativity exists within the social affordances that interact with the student (actor) who proceeds to develop a creative artifact for an audience (McLure et al., 2024). Glăveanu (Richard et al., 2023) asserts that ‘creativity is concerned with the action of an actor or group of actors, in its constant interaction with multiple audiences and the affordances of the material world, leading to the generation of new and useful artifacts’. Actors are characterized as socially developed beings who engage with and shape sociocultural environments through interaction with others. Besides being partners in creation, the audience encompasses all types of social forces exerted by others who evaluate, critique, or utilize the creative act. Those actions are influenced by the environment (i.e., affordances), potentially resulting in the emergence of artifacts. Creators, creating, collaborations, contexts, creations, consumption, and curricula are the components in Lubart’s seven Cs framework. For example, creators are the persons who create, creating is the creative process, creations are the artifacts or products, and context is the social and cultural environment in which creativity occurs. Consumption refers to the adoption of creative products. Lastly, a component that is not in the other models is the curriculum. This directly implies that creativity needs to be seen as something that can be taught, suggesting ways of teaching (Sternberg & Karami, 2022).

All of these frameworks share at least four dimensions (Thornhill-Miller et al., 2023):

- a. the process of creating,
- b. the creative product,
- c. the creative person,
- d. and the press, meaning the social and physical environment that fosters or hinders the creative process.

The creative process refers to all of these cognitive mechanisms that occur during creativity. A process is the method that a person uses to conceive, brainstorm, and hone a creative idea. The term ‘process’ refers to a range of behaviors and acts that a person exhibits, both consciously and subconsciously. The creative product is the outcome of the creative process, the artifact that has been developed that could be ‘original’ and ‘useful’ according to most definitions of creativity. Person refers to the characteristics and personal

traits of a creative individual. In the end, the press is about the characteristics of the environment in which creativity occurs. Finally, it is worth mentioning a well-known developmental framework for creativity that emphasizes the product. It is the four C framework from Kaufman and Beghetto ([Zhang et al., 2025](#)). According to this framework, creativity is divided into four different creative products:

- Mini-c creativity is when we learn something new.
- Little-c creativity is when insights of creativity might be of value to other people as well.
- Pro-c creativity is when someone shows creativity in their profession, like a scientist who publishes an article.
- Big-c creativity refers to the creativity of eminent individuals who changed the world, for example with their art or inventions.

Due to the nature of creativity as being interdisciplinary, plurality exists also in definitions of creativity in education. According to Plucker, ‘Creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context’ ([Plucker et al., 2023](#)). According to the standard definition of Runco, creativity is the process that leads to new/original and useful/effective products ([Runco, 2023](#)). Amabile spoke about a creative product that has been novel and useful. She also defined creativity as a behavior resulting from constellations of personal characteristics, cognitive abilities, and social environments. Most definitions of the product will agree to some extent with the originality and usefulness aspect. Research suggests the importance of explicit definitions that are addressed in a multi-faceted manner ([Puryear & Lamb, 2020](#)).

Following the literature of definitions of creativity in education, we can see that creativity is deeply connected with the social and cultural environment where the creative process is taking place. Indeed, Csikszentmihalyi asserts in his systems model that creativity lies in the interaction between the individual, the domain, and the field ([Córdoba-Pachón et al., 2021](#)). Creative work intersects between these aspects and is developed and diffused based on the judgments and interactions of its members. The field includes critics, who evaluate creative ideas. Recognition and validation by the field are crucial for a creative idea to gain impact. Based on the conceptual references presented, a few conclusions can be made regarding important connections to Vygotsky’s zone of proximal development. Firstly, creativity is something that can be developed, like knowledge in the zone of proximal development when we move from lower states to higher states of knowledge ([Korucu-Kış, 2024](#)). Recent research has shown that students’ divergent thinking can be developed in response to relatively simple context cues. In addition, there is considerable variation in the level to which students’ divergent thinking is malleable, which suggests the presence of a certain zone in students’ maximum growth regarding creativity ([Dumas et al., 2021](#)). Secondly, in the work of Csikszentmihalyi and Rhodes (four Ps), we can find a common component, which is the field or the press. This is the social and cultural context in which creativity occurs. According to Vygotsky’s ZPD, the social environment plays a crucial role in learning. There is a gap between what a learner can do independently and what they can do with help. Teachers or more capable peers bridge the gap by scaffolding the process of learning.

The above findings can be summarized in Figure 1. The figure shows the intersections between the eminent theories of creativity (the systems model of creativity and the four Ps) and the ZPD, implying a new way of thinking about creativity, emphasizing the cognitive procedures when addressing the person and the process (individual) and the scaffolding of the teacher when addressing the product and the press (domain, field). The four components of the four Ps can be interpreted as follows: The process and the

person are what the individual can do. For example, a student uses creative processes like brainstorming, research, or questioning to reach a higher level of cognition. The teacher uses these strategies to evoke creativity. This stage is what we might call ‘before’, at the beginning of the ZPD. When in the ZPD, the teacher interacts with the domain (technology, knowledge, norms, and skills needed to facilitate creativity) and the field to aid the creative process. The teacher creates learning environments that foster creativity (press/domain). For example, they create open-ended assignments or problem-solving, which are activities and methodologies that foster creativity. The final product is validated by the teacher, as they are the experts in their field, by assessing it. The whole process can be circular until higher levels of creativity occur. The teacher is omnipresent in the process, bridging the gap with collaboration and guidance. The above schema can be applied as a point of reference when we study creativity. Following the above schema, we will elaborate on the concepts of creative person, creative process, creative press, and creative product. This will help the schema to become more practical, as we see which mental processes the person uses to be creative, which learning environments (press) foster creativity and which skills (domain), what are the characteristics of the creative person, and what is the creative product according to the literature.

4Ps and Systems Model under the Zone of Proximal Development

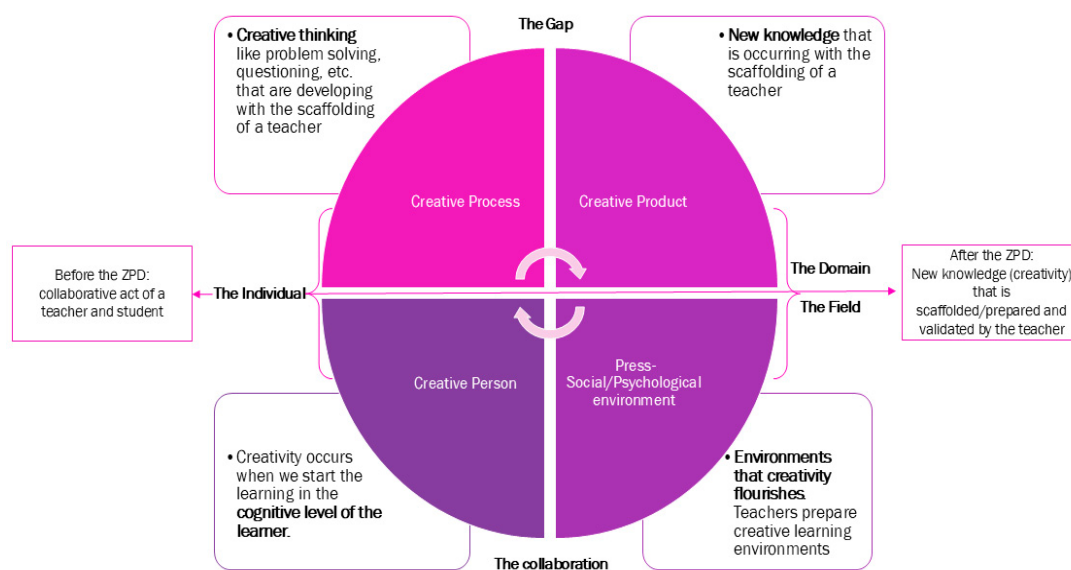


Figure 1. Four Ps and the systems model under the zone of proximal development.

A creative person is an individual who is open to experiences and is not afraid to make mistakes. They embrace reasonable risk-taking seek the new and learn through failure (Henriksen et al., 2021b). Furthermore, creative individuals are highly motivated and enthusiastic about their work. Scholars reported that creative people are self-disciplined; they cope with frustration and have their judgments on things (Wu & Wu, 2020). We understand that in the above schema, creativity occurs when we are in alliance with the cognitive abilities and interests of the learner. We cannot talk about enhancing creativity when we begin learning from a level of drill and practice and standardized testing. A teacher should start the creative process when knowledge has been achieved. According to Bloom’s revised taxonomy, creativity requires the application of knowledge, analysis, and evaluation before it can occur. Also, teachers should provide activities like play and experiential learning, which take into account the personality of the creative person.

The creative press component is highly important as it refers to building environments that foster creativity. This encompasses the psychological, pedagogical, and physical factors of a formal learning environment (in-person or online) or non-traditional learning. Creative environments often foster collaboration, value students' ideas, embrace mistakes, and support reasonable risk-taking. For example, open-ended interdisciplinary projects focusing on real-world problems can increase creativity. Curiosity-driven activities like exploring new media technologies, play, outdoor activities, model making, building, planning, and engaging in design activities are also important when developing creativity (Henriksen et al., 2023).

According to Amabile, the creative process has the following phases: (a) identifying tasks, (b) preparation, (c) generation of responses, (d) validation and communication of responses, and (e) results (Fisher et al., 2021). This process requires subject-matter expertise and skills like critical thinking and problem-solving. The creative process is both a cognitive and a thinking skill. Several frameworks have been developed to outline the creative process. In a recent study, the Australian Council for Educational Research (ACER) defines creative thinking as 'the capacity to generate many different kinds of ideas, manipulate ideas in unusual ways, and make unconventional connections to outline novel possibilities that have the potential to meet a given purpose elegantly' (Karunaratne & Calma, 2024).

A creative product is the result of the creative process. Runco and Jaeger, in their standard definition, identify two components of creativity: novelty or originality and usefulness or effectiveness. Novelty means that a creative product brings something that did not exist before or is at least relatively original in context. Effectiveness means that the product is useful, logical, understandable, or provides value to others (Creely et al., 2021). Creative products in education can be a creative artifact that a student or a teacher makes. In the above schema, we interpret the creativity components in terms of the ZPD and the roles/interactions of teachers and students.

3. Vygotsky's Life and Work as a Paradigm of Creative Thinking

Vygotsky (1896–1934) experienced a time that compelled him to consider the type of education necessary in this emerging communist society. He was a scholar who managed to achieve a novel synthesis of the contemporary scientific work of that time to develop his theory in pedagogy. He is recognized for laying the groundwork of cultural psychology and cultural-historical theory, which highlighted that human change and development, especially the evolution of our thinking, is shaped by society and culture (Zavershneva & van der Veer, 2021).

Vygotsky was a creative scientist who combined knowledge from different domains like literature and psychology to create his theories. This is related to combinatorial creativity, meaning that creativity comes after the collision of pre-existing ideas. Additionally, his thinking with images to create his metaphors was borrowed from literature and poetry. His famous meteorological metaphor speaks of the embodiment, and objectivation, by which thought becomes visible in words. Creative thinking can share similar metacognitive functions instead of Creative thinking shares these same mental functions. Mishra, in his work on Transdisciplinary Creativity, speaks of six cognitive skills: patterning, abstracting, embodied thinking, modeling, play, and synthesis. These skills allow people to transfer information creatively from one domain to another (Mishra & Henriksen, 2018).

Vygotsky argued that if the existing social and cultural networks or practices do not provide adequate opportunities for an individual, psychologists should strive to use their expertise to alter these practices. According to Vygotsky, the results of these endeavors serve as evidence for or against the validity of scientific knowledge and thus establish

its final criterion of truth ([van der Veer, 2021](#)). In other words, Vygotsky believed that the gatekeepers that validate the educational practice were psychologists. This can be connected to the theories about creativity, especially about the creative product that needs to be validated at least as original and/or effective by the people who are in each domain. According to Csikszentmihalyi's system model, the field is important in the gatekeeping and evaluating of creativity. However, in today's online and digital environments, the gatekeepers have changed, because new tools allow creators to bypass old gatekeepers; for example, the internet, with YouTube, allows common people to be the evaluators of the videos ([Henriksen et al., 2021a](#)).

Furthermore, Vygotsky's sociocultural theory highlights the importance of social interaction, collaboration, and cultural context in the processes of learning and development. Learners are seen as engaged individuals who contribute to knowledge-building via interactions with their peers and teachers ([Kilag et al., 2024](#)). Scaffolding and collaboration in supporting creativity in today's technology-enhanced classrooms can be updated with the following roles: the concept of 'computer as nanny', which refers to technology's ability to support the creative process by creating a nurturing environment and fostering a creative mindset; the idea of 'computer as pen-pal', which suggests that technology can aid in communication and collaboration during creativity, allowing learners to exchange perspectives that might result in deeper creative insights; the term 'computer as coach', which implies that computers can serve as expert systems, enhancing students' creativity by offering tutorials and exercises that promote creativity-related cognitive processes, strategies, and techniques; and lastly, the notion of 'computer as colleague', which means that computers can serve alongside learners in the creative process, actively participating in the generation, evaluation, and refinement of ideas ([Bereczki & Kárpáti, 2021](#)). To sum up, Vygotsky's sociocultural theory of cognitive development is associated with creative thinking and creativity theories. This can be seen not only in his work and life but also in synchronous human-computer interactions, as expressed in this chapter.

4. Creativity in Teacher's Education

The Organization for Economic Cooperation and Development (OECD) 2005, twenty years ago, made the following statement about what must include the definition of an ideal teacher: being enthusiastic and creative ([Ayyildiz & Yilmaz, 2021](#)). Creativity indeed is very important in the lives of teachers as creative practices keep them motivated throughout their professional lives. Teacher creativity significantly influences student creativity because creative teachers serve as role models. Teacher creativity can follow the same definitions that dominate the field in terms of novelty and usefulness. Novelty can be new practices and new pedagogy and the effectiveness and the value that these new entries have in the teacher's or other teachers' and communities' practice ([Fischer, 2020](#)).

However, the relationship between creativity and teaching can be seen in two ways: teaching for creativity and teaching creatively. Teaching for creativity promotes a learning environment that encourages students' creativity. For example, a science teacher can ask students to embody geographic places with gestures. Teaching creatively is the capacity to be imaginative, willing to take risks, reflective, and open in how they teach ([Anderson et al., 2022](#)). Creative teaching, according to this definition, is the ability to utilize high-quality ideas that 'represent something different, new, or innovative' ([Henriksen et al., 2024](#)). Creative teachers create learning environments where they can push boundaries, explore possibilities, and try new things. The practices teachers choose for fostering creativity include learning activities that require flexible thinking, experimentation, exploratory thinking, and expression of feelings without passing judgment. ([Henriksen et al., 2024](#)). However, there are barriers to teacher creativity. There is not a clear framework/definition for them to

understand teacher creativity. Teachers seem to be reluctant to change. Higher institutions seem to lack the necessary resources to help educators develop their creativity (Han & Abdrahim, 2023). Professional development programs are important for cultivating creativity skills in teachers. This project becomes even more difficult if we consider the challenges teachers face in technology-enhanced classrooms because they must have the necessary creative skills to connect pedagogy, technology, and content in their learning designs.

5. Creativity in Learning Design with Technology

In contemporary classrooms, the teacher's role has changed. There is an attempt to empower teachers as learning designers and support this initiative within their professional development. According to Conole, learning design is a 'methodology for enabling teachers/designers to make more informed decisions in how they design learning activities and interventions, which is pedagogically informed and makes effective use of appropriate resources and technologies' (Hrastinski, 2023). Laurillard argues that the role of educators is 'not to transmit knowledge to a passive recipient, but to structure the learner's engagement with the knowledge, practicing the high-level cognitive skills that enable them to make that knowledge their own'. She calls teachers to 'become designers' themselves and to re-frame teaching/learning activities as 'design interventions' (Paaskesen, 2020). Of course, the shift to learning design did not occur unexpectedly. The advent of information and communication technologies for learning has been expanded in many ways in recent years, providing opportunities for teaching and learning. Because of this phenomenon, teachers need to re-design their lesson plans, providing new opportunities for new skills in the digitalization and automation era.

For this purpose, a plethora of technology-enhanced learning design frameworks have been developed. An important framework for learning design using technology is the conversational framework by Laurillard. The conversational framework by Laurillard introduces six types of activities that could help students in the learning process. The teachers use them to design learning experiences using technology effectively. These are acquisition, inquiry, discussion, practice, collaboration, and production (John et al., 2024). Each type of activity is circular and encompasses the interactions between teacher and student or student and peers. In summary, acquisition refers to activities that allow students to learn by reading a book or article, watching a video or lecture, or listening to a podcast or audio. Inquiring is when students use inquiry to gather information, examine sources, and assess their findings. Discussion is when learners share ideas, pose questions, or respond to queries from peers or the teacher. In practice, students apply their knowledge and receive feedback. They respond to a task using the knowledge they have gained in class and receive feedback on their work so they can try the task again. In collaboration, students cooperate with their peers to create a common product through group feedback, negotiation, and teamwork. Lastly, in production, we have activities that allow students to demonstrate their learning by producing something for the teacher to evaluate. They create learning artifacts (Yong et al., 2020). Another important framework is the seven Cs by Conole. This framework speaks of seven stages when designing: conceptualize, capture, create, communicate, collaborate, consider, and consolidate. Before the course, instructors outline what the course entails, its objectives, and its pedagogy (conceptualize). Throughout the course, students participate in tasks that offer chances for developing learning artifacts (create). In this stage, they communicate and collaborate in teams (collaborate). Additionally, they are reflecting on their progress with assessment tasks (consider). When the course ends, learning designers/teachers reflect on the success of the course, considering the time, the tasks, and the activities (combined). In this final stage, they make necessary changes to update the course (consolidate) (Goshtasbpour et al., 2022). The four Ts approach devel-

oped by Pozzi and Persico supports decision-making and pedagogical planning regarding tasks, teams, technology, and time, in computer-supported collaborative learning activities. According to this model, when teachers design a collaborative learning activity, they first need to define the objectives and specify the content and context. After this phase, they can decide on a task to be assigned to students, the technology that will be used for the task, the social structure of the class, and the time needed. Any decision made regarding one of these variables inevitably affects all of the others, making the design process inherently iterative (Pozzi et al., 2024). In a recent critical analysis of the frameworks, it was found that the eminent pedagogy among the models was social constructivism. From the analysis, seven models either directly or indirectly (for example, through the inclusion of collaborative learning elements) endorse social-constructivist learning (Bower & Vlachopoulos, 2018). In the frameworks mentioned, we see the words collaboration and teams, implying a tendency for collaborative learning. Teacher and student interactions are important in learning design, like in the ZPD.

However, guidance on integrating technology is rarely provided within these frameworks. This is why we need to address the issue of technology integration through some important models and frameworks. Technology plays a crucial role in contemporary classrooms. Teachers must be prepared to use tools they may have never experienced before. Technology integration models help educators evaluate and improve the use of technology. TPACK is a very famous model for technology integration that also serves as a technology-enhanced learning design framework. It was developed by Mishra and Koehler in 2006. TPACK argues that expert teachers have a blend of technological, pedagogical, and content knowledge. Thus, it is the interaction between knowing technology, knowing about pedagogy, and understanding subject matter that makes for effective teaching using technology. Teachers need to be able to creatively utilize this interaction because tools in most cases are not designed for pedagogical purposes; they evolve rapidly, and this is something we must keep in mind when designing learning experiences (Mishra et al., 2023). Another famous technology integration model is the Triple E model by Liz Kolb, which stands for three Es in technology integration: engagement, enhancement, and extension. Kolb suggested that helping educators measure how well technology is integrated into lessons is helping students engage in, enhance, and extend their learning goals. She created a practical lesson rubric with these three criteria. At the engagement level, technology aids students' motivation to focus on the task and active learning. At the enhancement level, technology helps students develop a more sophisticated understanding of the content, reaching a higher level in cognitive stages, and creating scaffolds and new paths for students to demonstrate knowledge. At the extension level, technology assists in experiential learning and authentic experiences because it creates opportunities for learning outside the typical school day, creates a bridge between school and everyday life, and helps students acquire everyday life skills (Al-Khalidi, 2021). Additionally, the substitution, augmentation, modification, and redefinition model (SAMR) speak of four stages of technology integration: substitution, augmentation, modification, and redefinition. When we reach higher levels of integration with technology, like the redefinition level, we have learning activities/tasks that would not be possible without technology. According to Puentedura's SAMR model, digital technologies can enhance or transform educational practice. When we reach the substitution and augmentation level, we are improving academic practice. Substitution means that technology acts as a direct tool substitute, without functional change. Augmentation acts as a direct tool substitute for functional change. At the transformational level, we have modification and redefinition. Modification means that technology allows for significant task redesign. At the highest and last level, in redefinition, technology allows for new tasks, previously inconceivable (Blundell et al., 2022).

A keyword that is fundamental in understanding the intersection between learning design and technology is the teacher's creativity. Craft and Mor define learning design as 'the creative and deliberate act of devising new practices, plans of activity, resources, and tools aimed at achieving particular educational aims in a given context' (Bardone et al., 2024). The emphasis on 'creative' highlights the nature of design, and in particular learning design, as a creative practice. Sawyer, (Keenan-Lechel et al., 2023), an eminent scholar of creativity and creative processes, views creativity as something teachers can design into a learning environment. He argued that *'Teachers can design experiences, and by engaging in those, a learner might learn to become creative'*. Technology plays a crucial role in today's classroom and teachers need to design their activities based on pedagogy, content, and technology. However, the process, according to TPACK, needs a teacher *'who creatively navigates the affordances and constraints of specific technical tools with the requirements of representing content for pedagogical approaches'*. TPACK emphasizes teacher creativity when designing lessons using technology (Mishra et al., 2023). Additionally, according to the four Cs model from Kaufman and Beghetto, technology could mitigate risk in classroom creativity by allowing for the testing of new ideas. In the next chapter, we will present how the new teacher as learning designer functions within the Zone of Proximal Development. Additionally, how was the Language changed and what interpretations can be made.

6. Learning Design Using Technology, Language, and the Zone of Proximal Development

The teacher's role in Vygotsky's theory is fundamental, as the teacher is the one who is scaffolding the process of knowledge. Vygotsky wanted to shift the focus from the teacher to the student (Barrs, 2021). The learning design process is student-oriented as well. In this section, we will analyze through the language theory of Vygotsky how technology-enhanced learning design is the new tool for the teacher not only to mediate knowledge but also as the key element to the learners' cognitive harmony between internal and external dialogue.

Vygotsky's sociocultural cognitive theory sees two important components in learning: language and the ZPD. Language has two operations in Vygotskian theory. The first is that language acts as a medium in which knowledge is transmitted by the teacher or a more knowledgeable person. The second one is that language is an important means of supporting a learner's cognitive harmony between internal and external dialogue. According to the first theory, language acts as a social transmitter. Language transmits the culture. However, anything regarding social structure is structured in spoken language. In technology-enhanced classrooms, the content has different mediators for these cultural transmissions. These new formats still encompass the teacher, their values, and the curricula, or in other words, the social environment. Additionally, they bring new ways of teaching and learning that were inconceivable in the time of Vygotsky. For example, the flipped classroom model allows us to interact with the teacher not only during classroom hours but also outside of school through a video, enhancing students' guidance and learning support. The key insight that arises when examining the flipped classroom through the lens of Vygotsky's theory is that this approach creates an appropriate setting for cultural transmission. The flipped classroom achieves this through two main avenues: (1) instructional videos created as lesson materials and (2) classroom time dedicated to employing active learning strategies (Erbil, 2020). Additionally, for the second component of Vygotskian theory, which states language is an important medium in learners' cognitive harmony, there are plenty of connections in the learning design field. In fact, in a call for action, Mor, Ferguson, and Wasson write that the 'learning design approach advocates a shift from a focus on content to a focus on the learning experience, to guide learners as

they make a transition from an initial state of mind to a desired one' (Wasson & Kirschner, 2020, p. 819). Furthermore, in the article 'Understanding Vygotsky', we see that the author argues that Acmeist psychology is connected to the work of Vygotsky, as both suggest the creation of a new, improved human being with the help of technologies, or in the case of Vygotsky, with cultural tools, language, and social collaboration.

While connecting the knots between language, sociocultural theory and learning design, we see that they all share the social approach. because it in its essence requires collaboration. As seen in the learning design frameworks, collaboration amongst practitioners is essential because it is important to share and reuse designs within a community. The ZPD emphasizes the collaboration between the teacher or a more knowledgeable person and the learner to bridge the gap between what a learner can do alone and what they can do with help. Glăveanu suggested the need for a new language of creativity in research and practice. Creativity can be seen in the interactions of new discourses. One new discourse is technology, and this should be accounted for when transforming the: language. Glăveanu emphasizes on the collaborative relationship between people and technology during the creative process. (Glăveanu et al., 2023).

In Figure 2, we see the new discourses in Language and the ZPD.

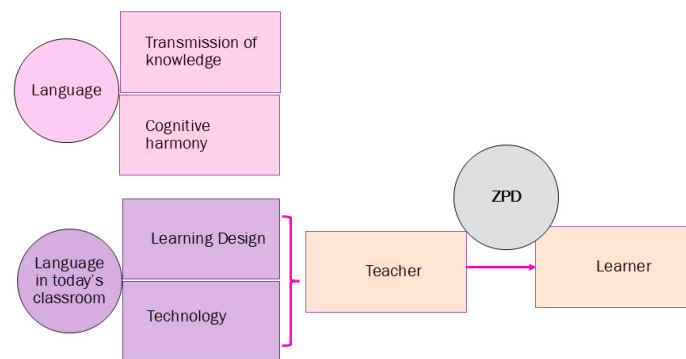


Figure 2. Learning design, technology, and Vygotsky's sociocultural theory.

Language now is the learning design itself and the technology that is implemented in it. Technology transmits the social and cultural context. For example, a video transmits the social context. This is the new language. The teacher communicates with the learner through this language. The new language enhances cognitive harmony as it has more ways to deliver the content and more ways to facilitate learning. It is an enhanced process in the zone of proximal development. For example, augmented reality (AR) provides remarkable opportunities for learners by enhancing sensory engagement. Recent research has indicated that significant factors influencing deep learning in preschoolers include the teachers' roles in constructivist and sociocultural theory when using AR technology. In this context, the educators' tasks are to collaborate and actively support children's educational journeys. They create the AR experience, interact, consider, and reflect with the students, assisting them in acquiring deep learning (Kelpsiene & Monkeviciene, 2024). Additionally, a recent systematic review and meta-analysis of articles showed the positive impact that AI and computational sciences have on student performance, especially in motivation and STEM (science, technology, engineering, and mathematics) areas (García-Martínez et al., 2023). There are numerous examples that show the advantages of technologies in the development of cognitive harmony and higher cognitive mental functions, but it is not the purpose of this paper to address them, but it is not the purpose of this paper to address these.

7. A Proposal to Redefine the Role of the Teacher as Designer with the Help of the Human Machine Pair Inspection Methodology

The contemporary teacher faces a lot of challenges. According to the National Advisory Committee on Creative and Cultural Education (NACCCE), *‘Young people’s creative abilities are most likely to be developed in an atmosphere in which the teacher’s creative abilities are properly engaged’* (Assimonye & Ibe, 2019). Creativity is on top of cognitive skills. In today’s classrooms, the teacher is primarily a learning designer for a technology-enhanced learning environment. To be able to solve the problem of pedagogical content and technology, a teacher must be able to think creatively about the learning designs. How can this be done effectively? The endeavor is important because research has shown that there is a correlation between effective and creative learning designs and effective and creative teachers and students (Tamsah et al., 2021).

The answer might be in the human–machine pair inspection (HMPI) methodology. Facing the era of machine learning and artificial intelligence (AI), new methodologies have arrived to assist humanity in multiple ways. One of them is HMPI. This is a software inspection methodology in which machines actively understand the program and assist the programmer in reviewing the code during its development (Dai et al., 2024). This definition reflects the central idea of HMPI as a collaborative process combining machine assistance with human expertise to improve software development and inspection outcomes. Concepts and methodologies such as HMPI are founded on an integration of software engineering principles, research in human–computer interaction (HCI), and developments in artificial intelligence (AI) and cognitive science. Since they are rooted in cognitive science, learning, and as a result education, can benefit from them.

As discussed in this article, Vygotsky viewed language as a tool for accelerating understanding. The language of the new teacher is learning design using technology. LD can help the teacher make scaffolding in the ZPD easier, as they connect pedagogy, technology, and content. The process is creative and collaborative, meaning both teachers as designers and technology itself must help in the creation of new knowledge. How can this be carried out more effectively? HMPI can assist in this endeavor. Creativity and knowledge generation through machines like artificial intelligence will play a significant role in various digital futures. In these scenarios, human creativity and subjectivity will be intricately linked with machine interactions and interventions. Following these lines, recent student research/AI collaboration (SAC) has shown some key findings. According to interviews with ten Korean teachers who use AI, for AI to support creativity, it should provide instructional scaffolding, adapt to student’s needs, and encourage exploration rather than just delivering fixed answers. AI could be used as an aid in the process of learning (Kim et al., 2022).

In the process of creating new products or new LDs, technology can act as an inspection tool validating or rejecting the circle. This is the ‘machine’ actor. The machine could be the learning analytics that is extracted through the Learning Management System (LMS), the LD graphical tools, or even artificial intelligence (AI) that will help the teacher interact with lesson planning more efficiently. LAs aim to convert learning data into knowledge that allows educators to implement suitable and evidence-based interventions to enhance teaching and learning (Banihashem et al., 2022). So, in an initial state, we can draw on data to design a scenario using technology. Secondly, LD tools are enhanced environments where educators create learning designs. Researchers asserted that LD tools help in the design process by enabling the teachers to articulate, contemplate, and evaluate their concepts (Zalavra et al., 2023). In this phase, we can give a scenario to a tool and then inspect the process. As for AI in education, new terms have been addressed. ‘Learning with AI’ refers to utilizing AI as a resource for teaching and learning. AI can help when

creating the prototype, before giving it to the LD tool. The above schema is represented below in Figure 3.

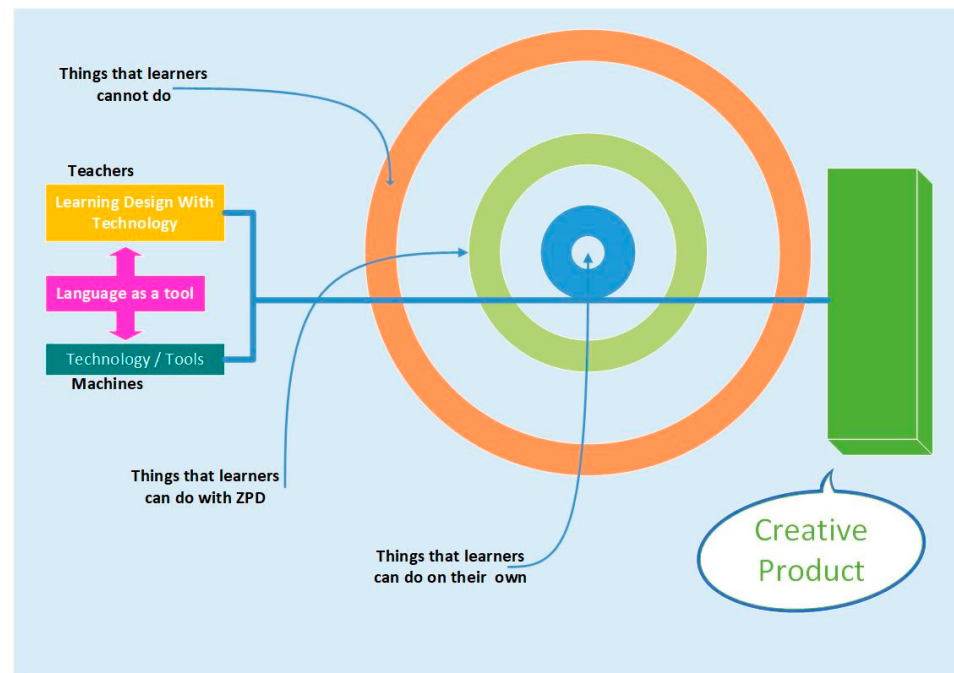


Figure 3. The HMPI process for creativity in the ZPD of the learning design with technology era.

This schema presents the following interactions: The teacher uses LD tools (machines) to represent the creative process of learning design. Learning analytics or AI can also be of value to validate that the lesson plans had an impact on positive student outcomes. The teacher creatively interacts with pedagogy, content, and technology to enhance the outcome. The teacher inspects and performs the procedure again until a final creative LD can be created. The creative output here is a lesson plan that encompasses technology, pedagogy, and content. Of course, it can also be new knowledge, or a creative artifact constructed by the student. The ZPD is important in showing what the teacher can do alone and what they can do with the help of the tools. The human–machine inspection methodology can be seen under this umbrella in education.

8. Conclusions and Future Remarks

Creativity plays an important role in modern education. It is an important skill for both teachers and students. Highly creative teachers are effective teachers according to the literature on highly accomplished teachers. The OECD’s Global Teaching Insights report further supports this, showing that classrooms with high-achieving students often exhibit advanced teaching practices (OECD, 2020).

However, according to the literature, teachers do not know how to implement creativity in their practices. Furthermore, their role has shifted from curriculum implementers to creators of effective learning designs for the needs of a learner-centered TEL environment. Furthermore, most of the technology that educators utilize was not created with education in mind. Teachers must therefore repurpose it for use in educational settings. In this new context, the teacher must have creative skills to create learning designs using technology, to make learning artifacts, or to create learning that is innovative and effective. Vygotsky in his sociocultural theory has spoken about language and the zone of proximal development. This theory can help us interpret the functions in teacher’s new role as creative learning designer. Language has two operations in Vygotskian theory. The first is that language acts

as a medium in which knowledge is transmitted by the teacher or a more knowledgeable person. The second one is that language is an important means of supporting a learner's cognitive harmony between internal and external dialogue. This relates to learning design using technology, meaning that in contemporary classrooms, we have another language that may be a video presentation or even an augmented reality/virtual reality (AR/VR) application. These new media transmit the sociocultural environment. In their new learning designs, teachers creatively combine the tools with content and pedagogy, developing a novel artifact. In the zone of proximal development, we now have the assistance of learning designs using technology. These are utilized by the teacher to help the learner go beyond their possibilities. The following research questions of this paper have been answered accordingly:

RQ1: What is the connection between creativity and the zone of proximal development? Creativity can be seen under the umbrella of the ZPD. It is an iteration of the person, the process, the product, and the press; and the individual, the field, and the domain. All of these components result in creativity, emphasizing individual and societal interactions, teacher and student functions and interactions. Thus, all of this can be seen as a unified theory when addressing creativity in the Vygotskian learning process. The implementation of the ZPD in creativity frameworks shows the deep connection between the learning process and creativity as both are collaborative acts that rely on the social environment to create new knowledge.

RQ2: How has the learning design field shifted the role of the teacher and how does this relate to (1) the theory of cognitive development from a constructivist perspective and (2) the theory of the zone of proximal development (ZPD)? The learning design field has shifted the role of the teacher. Teachers now need to design effective lesson plans using technology. Language was a tool in Vygotsky's theory that has changed and evolved. LDs and technology are the new means for a teacher and a learner to collaborate. In this paper, we saw some examples of the impact of new technologies like AR/VR or AI on the 'language' of a teacher. The examples are numerous. This must be addressed, and new conclusions can be made about the role of teachers in contemporary classrooms and how they approach learning.

RQ3: What are the connections between the new role of the teacher as a designer with creativity and technology in ZPD? Creativity is very important in teachers' skills when designing a lesson. This is especially true when this lesson involves technology. Technology can help teachers be more creative in their practices. According to HMPI, tools like AI or LD graphical tools and learning analytics can help when designing lesson plans to be more creative and effective. The tools can help teachers review the design process when designing using technology. This could lead to novel and effective lesson plans or new knowledge. The ZPD is important in showing what the teacher can do alone and what they can do with the help of the tools. The human-machine inspection methodology can be seen in Vygotsky's theories in future research.

The above connections highlight the need to see the teacher in a new role, not only as someone who utilizes technology, content, and pedagogy but also as someone who has the creative skills to design ideal and effective lesson plans using technology. Effective teaching results in positive student outcomes, so the discussion that has opened is essential. Knowledge about creativity within the process, the person, the press, and the product will help teachers collaborate with learners in a much more efficient way. Additionally, technology will be a tool in this process to further enhance learning. AI or analytics and LD tools can assist in the design process. The creative teacher/designer inspects the tools for optimal interactions and creativity, giving evaluation and feedback.

Empirical data are important to test and validate the above research questions. Case studies were designed and implemented in the University of West Attica addressing the

issue of creative learning design using technology in teacher professional development programs. The design of these interventions consisted of the collaborative creation of technology-enhanced learning scenarios that were created using LD tools and applied within the scope of creativity and technology-enhanced learning. The findings indicate that teachers can indeed design more innovative lesson plans if given the right context and knowledge to create their LDs.

Further research using various tools to assist in the creative process of learning design using technology like LA and AI will further establish the hypothesis and lead to more conclusions that will help contemporary teachers in their quest for creative learning design using technology.

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