

Article

Introducing Personal Teaching Environment for Nontraditional Teaching Methods

Yasser El Geddawy ^{1,*} , Fernando A. Mikic-Fonte ² , Martín Llamas-Nistal ²  and Manuel Caeiro-Rodríguez ² ¹ Department of Business Information Systems, Arab Academy for Science, Technology and Maritime Transport, Cairo 12577, Egypt² atlanTTic Research Center for Telecommunication Technologies, Department of Telematics Engineering, University of Vigo, 36310 Vigo, Spain; mikic@det.uvigo.es (F.A.M.-F.); martin@uvigo.es (M.L.-N.); mcaeiro@det.uvigo.es (M.C.-R.)

* Correspondence: yasser.algeddawy@aast.edu

Abstract: Students use technology in various ways to learn. The differences in their learning goals and needs make it challenging for teachers to be more engaged in designing educational tasks, assisting, and coping with their students learning. This paper introduces a novel structure of a concept for teaching called Personal Teaching Environment (PTE). This contribution aims to provide teachers with PTE components (tools, connections and activities, and data sources) that can facilitate the fulfillment of their educational tasks for them. The main goal of this study is to define the concept of PTE and its components, as well as to investigate the most popular nontraditional teaching methods and to relate PTEs to these methods with application examples. Therefore, this paper addresses the following questions: (a) What is the structure of PTE, and how does it work? (b) What are nontraditional teaching methods' advantages, frameworks, and successful implementation stories? and (c) How would you categorize the tool types of nontraditional teaching methods to serve PTE applications? A review was conducted to achieve these goals, and a total of 93 peer-reviewed articles pertaining to the most frequently studied nontraditional teaching methods were comprehensively studied and analyzed. The analysis resulted in practical guidelines, including the benefits and tool types of the five studied nontraditional teaching methods (flipped classroom, problem-based learning, gamification, case study, and social media-centered). Based on the results, the authors established significant examples for teachers who aim to use one or more of those nontraditional teaching methods through the adoption and utilization of the PTE applications.

Keywords: Personal Teaching Environment; nontraditional teaching methods; e-Learning; review of methods



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1. Introduction

The Internet is changing and affecting the way teachers teach nowadays. Much effort is directed to developing e-Learning systems that help learners and teachers in their education (e.g., Learning Management Systems (LMSs), and Virtual Learning Environments (VLEs)). These solutions have played a vital role in the last several years in the educational sector. Nevertheless, despite educational institutions' efforts to adopt such systems, learners usually also use other applications for learning that they already use for other purposes in their daily life, even if they are encouraged to use a specific e-Learning system [1]. The following are the most significant limitations of the e-Learning systems mentioned above: (i) personalization is limited; (ii) teachers and students do not have lifelong support or access to their data; (iii) content audience is limited; and (iv) informal learning is not supported.

We assume that personalized learning/teaching environments are the future of learning because of their flexible structure, diverse physical locations, and contexts in which students learn. The Personal Learning Environment (PLE) concept acknowledges the

individual's involvement in organizing their learning tools. According to this concept, various students would use different—and not necessarily digital—tools [2]. A PLE is not limited to being a specific tool, but rather a way of organizing educational activities, tools, and data sources [3]. In most PLEs, Web 2.0 tools and services play a significant role, but they can also be composed of additional solutions that allow students to collect, process, and exchange information and knowledge [4]. Adell and Castañeda defined PLE as “a set of tools, data sources, connections and activities (experiences) that each person uses habitually to learn” [5]. These learning environments can be a preferred alternative to the traditional classroom, which has a limited and traditional structure. Within the PLE concept, students have their preferred ways to learn, and learners must complete the learning; the aim is to create an environment for learning that enhances the ability of students to acquire information and grow. The involvement of the teacher in this kind of scenario is necessary, as the teacher's role is vital and cannot be changed or replaced. Though students can work on their own in a PLE, guidance and assistance are needed in their learning to ensure education quality.

The process of a teacher designing and assessing a course is sophisticated and time-consuming since it requires both the creation of and search for educational resources as well as assessment methods. Additionally, taking into consideration that learning goals (e.g., negotiation skills, critical thinking, and problem-solving skills) and needs (e.g., competence, self-determination, and relatedness) are different (it is more important to know where to find information than having a lot of knowledge), learners themselves are also different (e.g., their capacity to be focused is small) and society also requires other competencies (e.g., the ability to work in teams) [6]. As a response to this challenge, we introduce the concept of a Personal Teaching Environment (PTE) which aims to assist teachers in their teaching responsibilities based on the idea of Personal Learning Environment (PLE) that assists students in their learning tasks. It is a teacher-centered concept that assists teachers in improving their performance and quality of teaching.

Personal Teaching Environments (PTEs) is not new as a concept [7–11]. However, none of the mentioned scholarly works introduce a framework or how it works with nontraditional teaching methods. PTEs are comparable in concept and structure to PLEs; i.e., PTE is a concept of how instructors teach in a technological environment. It contains: (i) a set of tools that can be personalized according to the instructor's needs; (ii) data sources that can be used in material preparation or assessing students; and (iii) connections and activities that each instructor may use to teach. However, the requirements and goals of students and teachers who use these kinds of environments are different. PTEs are designed to meet the demands of teachers by allowing them to connect with students' PLEs, but also enabling teachers to analyze, guide, and also assist them in preparing and delivering their tasks. A PTE aims to assist instructors in having control of and managing their own teaching. This involves assisting individual instructors in setting their own teaching goals, managing their teaching methods and resources, and connecting with other teachers for sharing their teaching experiences. Furthermore, teachers may also use PTEs involving the use of specific tools to facilitate the completion of their tasks while using traditional or nontraditional teaching methods (e.g., flipped learning and problem-based learning) and for their professional development.

Traditional teaching methods are based on explaining a topic in a textbook, note-taking, lectures, or onboarding; the learner is not an active participant [12]. Nontraditional teaching methods usually involve encouraging students to participate in class activities, triggering their curiosity and creativity, and enhancing communication with others [13–15]. Effort is spent providing teaching methods that can be used with different types of students, as it is impossible to find one method that is fully compatible with all students' different abilities and skills [14,16]. Teachers usually include one or more teaching methods in their teaching activities. That raises one important question with the current information and communication technologies (ICTs): How does one give guidance to teachers and facilitate the creation of teaching activities in different nontraditional teaching methods? We propose

the Personal Teaching Environment (PTE) as a solution to facilitate the involvement of the teacher in this kind of teaching method.

The goal of this paper is to introduce the concept of PTE and provide PTE application examples while using nontraditional teaching methods. In this study, we intensified our efforts to illustrate some commonly used types of nontraditional teaching methods. We also focused on stating the activities, tool types, advantages, frameworks, processes, and successful implementation stories of the selected methods. Moreover, we provide tool types and application examples of PTEs enabling the development of some nontraditional teaching methods. The results of this study can assist instructors with selecting the teaching methods and the tools that could most effectively meet the learning objectives of their courses.

To attain the goals of this study, the authors analyzed 93 peer-reviewed articles to find the answers to the following questions:

- (1) What is the structure of a PTE and how does it work?
- (2) What are nontraditional teaching methods' advantages, frameworks, and successful implementation stories?
- (3) How would you categorize the tool types of nontraditional teaching methods to serve PTE applications?

The rest of the paper is structured as follows. The next section describes the PTE concept and its structure. Section 3 describes the most popular nontraditional teaching methods. Section 4 illustrates the methodology used to achieve the objectives of this study. Section 5 addresses advantages, tool types, tools used, frameworks, and successful implementation stories of the considered nontraditional teaching methods. Section 6 describes the examples of PTEs while using the selected methods. Section 7 illustrates the work's limitations, conclusions, and future work.

2. Methodology

A four-phase research methodology was developed to fulfill the objectives of this study, as presented in Figure 1.

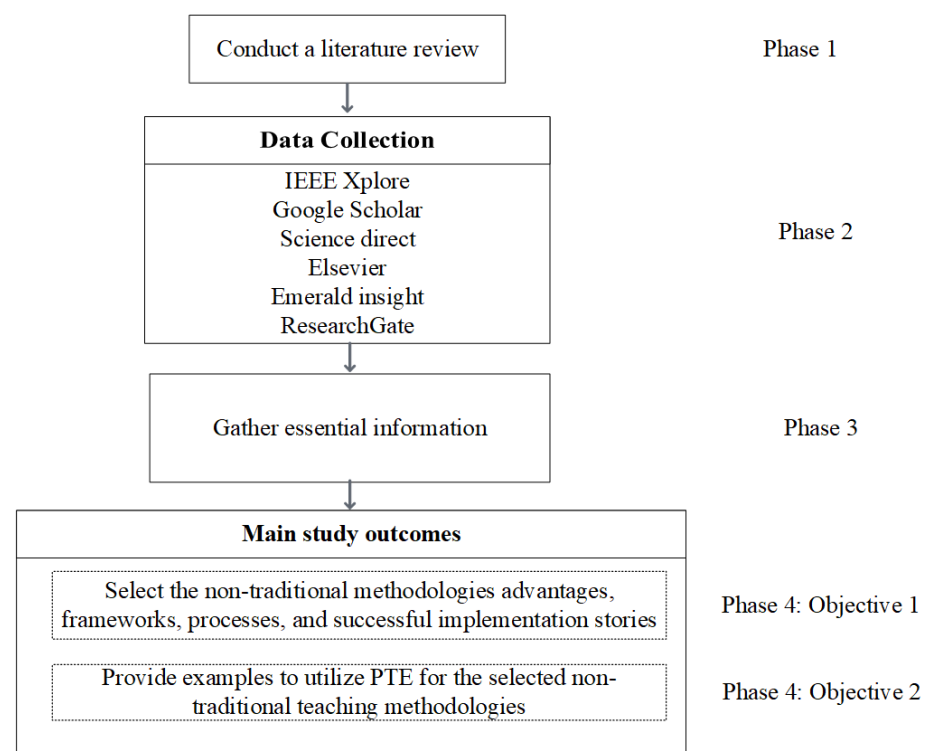


Figure 1. Research methodology.

The first step was a comprehensive literature review. In the second step, the authors collected relevant scientific publications using several search engines (e.g., IEEE Xplore, Google Scholar, Science Direct, Elsevier, Emerald Insight, and ResearchGate). Publications on nontraditional teaching methods, and likewise PTE, in general, were identified from 2000 to 2020. The search terms that were used are the following: ‘personal teaching environment’, ‘personal environment’, ‘personal learning environment’, and ‘non-traditional teaching methods’ in various combinations. The selection of papers was based on seven criteria:

- Scholarly references were highlighted and supplemented by academic publications from 2000 to 2020.
- Journal and conference papers were selected only if they contained at least one of the search terms in the title, abstract, or keywords to ensure data collection relevance.
- The only publications selected were ones that had nontraditional teaching method or personal teaching as a major or influential aspect of the research.
- Highly technical articles focused on technical aspects of PTE.
- The paper must be published in English language.
- The paper must have been published by one of the distinguished publishers such as IEEE.

The authors searched academic databases that contain reviews for the most frequently studied nontraditional teaching method to include them in our review. The search resulted in three scholarly sources, as shown in Table 1.

Table 1. Articles that met inclusion and quality criteria.

Paper Type	Studied Methods	References
Systematic review	Flipped classroom, gamification, case study, and social media-centered	[12]
Report—evaluative	Flipped classroom, problem-based learning, social media-centered and gamification	[17]
Systematic review	Problem-based learning, and case study	[18]

As a result, we can conclude the following from Table 1:

- (1) There is not much information relating PTEs to nontraditional teaching methods.
- (2) The five frequently studied nontraditional teaching methods identified in the collected scholarly sources were: flipped learning, problem-based learning, gamification, case study, and social media-centered.

After this, we conducted a second study (the process is presented in Figure 2), over the initial sampling frame of 2000 articles, for gathering essential information about the activities, tool types, and tools used in these five methods. After excluding the papers that did not meet the criteria, 93 papers remained; those were reviewed in-depth to investigate nontraditional teaching methods that needed to be involved in the PTE creation examples which could improve the involvement and engagement of the teachers with the students in the teaching process.

In the fourth step, the outcomes of the study were presented and divided into two sections: (i) the advantages, frameworks, processes, and successful implementation stories of the selected five nontraditional methods were investigated and identified; and (ii) the PTE examples were built according to the selected nontraditional teaching methods findings.

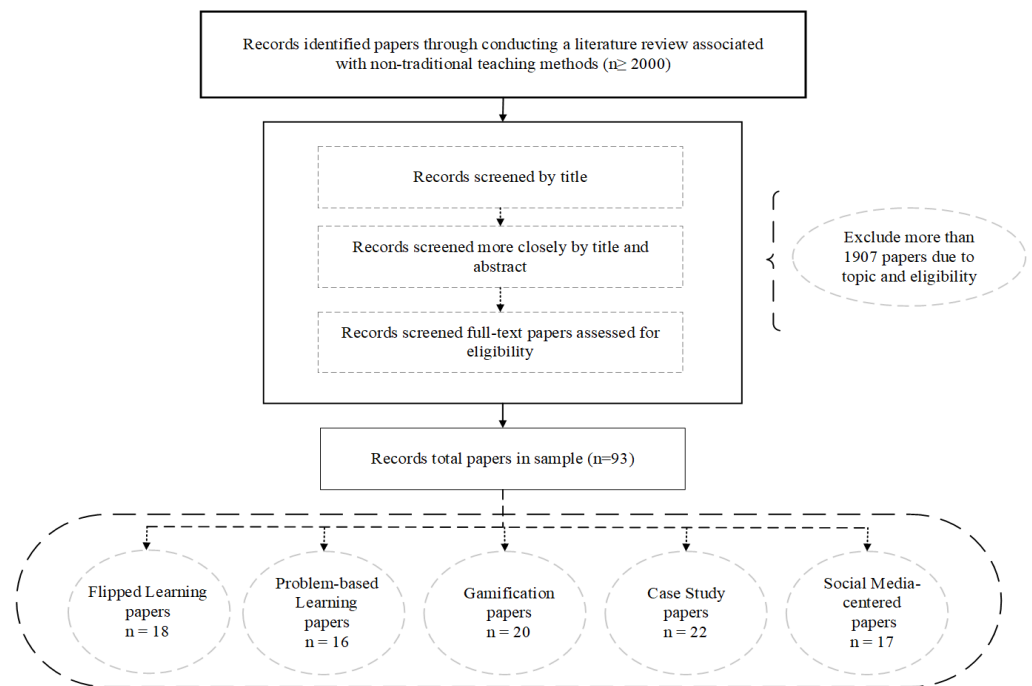


Figure 2. Process of paper search and selection.

3. Personal Teaching Environment

In this section and its subsections, we present the findings of research question 1 as follows: First, we define the concept of PTE. Second, we illustrate its framework. Third, we describe PTE components.

Personal Teaching Environment (PTE) is a concept regarding the scenario on which teachers teach in a technological personalized environment. PTEs facilitate teachers' reach to students' Personal Learning Environments (PLEs), making it easier to access students' favorite tools and data sources, observe students learning progress, and give immediate feedback. PTE can be defined as a set of tools, connections, activities, and data sources that each teacher regularly uses in their teaching [19]. The teacher has complete control over the tools and content of owned PTE, which is not limited to a certain course or educational institution and can expand and develop throughout the course of the teacher's profession.

Besides allowing teachers to connect to students' PLEs, it makes the teacher communicate with other teachers and access other data sources in order to achieve different educational objectives. We cannot say that PTE is a tool or platform, but rather a concept to organize various tools that serve educational purposes. The PTE is unique for each teacher, and it continuously changes according to the teacher's needs and experiences. Each teacher chooses their preferred tools and connects them to collect, create, organize, process, share information with students and peers, and manage their knowledge. The cumulative effect of the tools, information, connections, data sources, and the knowledge created is what creates the PTE.

Figure 3 gives an overview of the proposed framework of the PTE and how it could work. As shown, a PTE includes: (i) a set of tools that a teacher can utilize or design based on his/her individual needs; (ii) connections and activities that each teacher can use to teach, connect, ask, share, or interact with other people; (iii) data sources that can be used in material preparation, monitoring, or enhancing professional knowledge and skills; and (iv) teaching methods that can be used to deliver the objectives of the course.

Tools are linked to connections and activities as well as data sources. In practice, teachers can connect with people or collect data from databases using thousands of online tools. YouTube, for example, can be utilized in a variety of ways, such as a database for educational videos, a tool for developing and releasing educational videos, a source for

connections, and so on. However, this does not make it a viable PTE since it lacks several capabilities that teachers require to complete their other tasks. There are two major aspects that affect the success of current supporting approaches for teaching. The first one is the information and communication skills teachers need to have to perform their work (e.g., planning, preparing lessons, and assessments). The second one is teachers' abilities to guide students by defining and applying the needed pedagogical criteria and relevant knowledge [20].

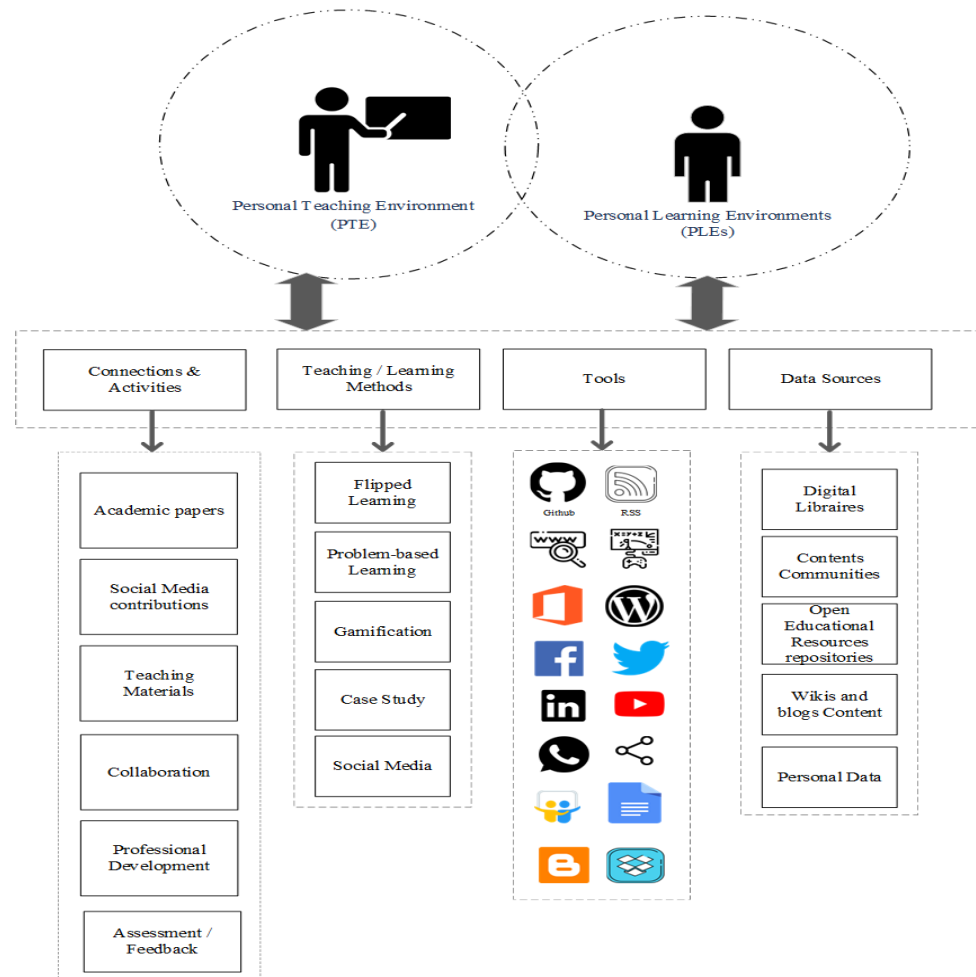


Figure 3. Personal Teaching Environment framework structure.

3.1. Tools

Each teacher will utilize a variety of tools to develop the PTE, but the environment as a whole may contain tools that are similar but serve different purposes. Blogs, file sharing, data repositories, research, communication (emails, etc.), planning (calendars, etc.), multimedia tools (videos, photos, audio), note-taking, assessment, presentations, materials, and so on are examples of these tools. As previously stated, a PTE is a set of tools (including devices/applications), social communities, and online resources and services that all work together to create a personal environment for a teacher. This could be used by a teacher to steer his/her own teaching and build his/her own competencies, as well as to broaden teaching goals. However, personalized and customizable tools can be designed and integrated into the environment to accomplish more individualized teaching goals.

Using such tools to create, organize, and exchange information for task preparation, teaching, or assessing students could enable teachers to develop, organize, and share content. Teachers could also communicate with students to observe how they learn, respond to their questions, and track the quality of learning they are gaining on a regular

basis. Teachers can connect with peers who share similar interests in order to improve their teaching engagement and effectiveness.

3.2. *Connections and Activities*

Teachers are more crucial than ever in educating students for a world that is always changing and where they have unlimited access to all forms of knowledge. To enrich students' formal and informal learning, a wide range of activities can be undertaken. Teachers must assist students in personalizing their educational experiences and utilizing learning aids that will enrich and support deeper learning. Furthermore, they must tailor learning to students' interests and requirements, allowing students to co-operate on projects and workshops to improve their learning skills. Teachers, on the other hand, require assistance in planning and delivering well-defined educational content to their students. In a PTE, a teacher can (i) design lessons; (ii) educate and engage with students; (iii) assess students; (iv) work with colleagues or other peers; (v) monitor students; and (vi) improve professional development.

In the context of using a nontraditional teaching method, the teacher has some activities that need to be performed to successfully fulfill the goals of using such a method. The teacher may need to join or create discussions, ask or answer questions to students or peers, edit wikis, etc. Likewise, giving feedback, tracking students' progress on social media, or helping in brainstorming to solve problems may be necessary.

3.3. *Data Sources*

Teachers require data to assist them to improve their teaching and supplement them with valuable information. Data can take the shape of files, movies, audio, papers, and other formats. These data can be found in a database or even a live data feed on a Database Management System (DBMS). A teacher can use online resource repositories such as OER (Open Educational Resources) repositories, online courses, wikis, blogs, journal and conference databases, professional development papers, or even YouTube videos from a certain community. Furthermore, data sources are not exclusive to professional development; they could include a collection of student data that can be used to assist or provide personalized feedback to a specific student.

Data can be presented in a variety of forms:

- Data used for preparing learning content. The data sources in this regard can be a YouTube repository, word documents, online presentations, or audio files.
- Data used for student assessment. The data sources examples for this can be question banks provided by a book's publisher or the teacher's provided institution. Moreover, they could be repositories of open educational resources that could have been previously used by other teachers in web services such as Kahoot or Socrative.
- Students' performance analysis data, obtained through collecting their static and dynamic data. Static data include their profiles, where they live, gender, past knowledge, etc. Dynamic data include their engagement in learning activities and their performance in assessment activities (for example, how long they read or watch a video).
- Data used for professional development. Data sources include professional websites (IEEE Xplore, ResearchGate, etc.). These databases can be used for research matters.

3.4. *Teaching Methods*

Teachers usually use one or more teaching methods during the period of teaching a course. It varies from the course structure, the type of information needed to be illustrated, and students' characteristics. Each method has some activities, tools, and data sources that the teacher needs to create and manage well to achieve the goal of using the selected method. In the next sections, we will explain how to engage these methods with PTE to facilitate the organization of the tasks while using nontraditional teaching methods for the teacher.

To conclude, the PTE framework was based on the idea that the teacher could choose an application as a hub to manage the various components of their PTE. Using a hub as the center of the PTE has many advantages [21]: (i) it makes it possible for teachers to have easy access to all choosing tools; (ii) it facilitates the management of diverse login cardinalities; (iii) in some scenarios, sharing data between some tools in the PTE is achievable; and (iv) it helps boost teacher engagement, interaction, and connectivity. PTEs support adaptive and personalized teaching and learning, allowing users to create, develop, edit, and configure teaching spaces and experiences. They allow them to choose their audience, using tools (e.g., personal profiler, content aggregator, recommender, progress tracker) to identify teaching and learning goals aided with social network groups that share the same goals [22].

4. Nontraditional Teaching Methods

In traditional teaching methods, the core information is transmitted by direct lecturing and directions offered by teachers, and is a way that many teachers have utilized during their extended careers in education. This method promotes educational processes that are directed by teachers by placing the teacher in the center of the classroom. Students expect to listen to and learn from lectures. Tests and exams are the most effective methods for assessing students' progress and the most important indicators of information acquisition. Students are in the same class and sit in the same seats. The majority of the assessments were derived from primary sources such as school textbooks that were related to the topics being taught [23,24].

With the advancement of education, nontraditional teaching methods, in contrast to traditional methods, are based on activity, questioning, explaining, demonstrating, and collaborating techniques. Some examples of these teaching methods are lecturer demonstration, usage of games for problem-solving, and viewing prerecorded video demonstrations. In addition, enacting role-plays to nontraditional methods such as virtual environments with avatars, classroom response systems, interactive interfaces, and live interviews with the teacher to engage the students in many ways [25].

Nontraditional teaching methods are generally known as innovative/modern teaching methods, as they make use of technology, animation, and special effects, and they are generally self-directed and interactive (e.g., the use of videos to improve content delivery) [25]. Nontraditional teaching entails learning in a variety of settings other than the classroom. Moreover, this gives students a new way to engage with what they are learning.

There is no scientific agreement on the best nontraditional teaching methods that are suited to learners' skills while also effectively addressing course objectives [12]. After analyzing previous reviews of nontraditional teaching methods [12,17,18], and according to these reviews results, we select five of the most frequently studied nontraditional methods, which are the flipped classroom, problem-based learning, gamification, case studies, and social media-centered. The authors of [26–28] defined the flipped classroom as a “pedagogical model in which the typical lecture and homework elements of a course are inverted”. The definition of problem-based learning according to [29,30] is “an instructional method in which students learn through facilitated problem-solving.” Gamification is “the use of game design elements in non-game contexts” [31,32]. The case study is “an approach that allows researchers to develop and present an in-depth view of a particular situation, event or entity” [33]. The researchers of [34,35] defined social media-centered as “a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content”.

5. Findings: Research Questions 2 and 3

In the next subsections, we present the findings of our research questions 2 and 3 of this study as follows: First, we present the advantages, frameworks, processes, and successful implementation stories of the selected five nontraditional methods with information found through the literature review. Afterward, in Section 6, we present a PTE creation examples for the below mentioned nontraditional teaching methods.

5.1. Flipped Classroom

In traditional teaching methods, teachers spend time teaching the students in the classroom and give students assignments and quizzes to complete at home. The flipped classroom, or, “inverted classroom”, is a type of blended learning [36] that changes the role of responsibilities of the classroom and home [37]. In a typical flipped classroom setting, students might watch prerecorded videos at home. The class time focuses on activities that enhance the overall learning environment [36], which improves the connectivity between students and teachers. Additionally, students are able to access their teachers through the videos at home and then again in the classroom. This eventually increases the chance for personalization and generates more accurate guiding of learning. Students practice under the guidance of the teacher while accessing their content. The teachers using flipped classrooms can apply a range of teaching methodologies such as video recording while lecturing, creating videos with screen-capture software, or using videos found online from databases such as YouTube or professional websites [38]. This allows teachers to improve communication and connect more with the students [39]. The authors of [40–42] provided a structure for flipped classroom settings, as shown below in Figure 4. The structure mainly contains preclass, in-class, and postclass activities that need to be completed. For successful implementation of the flipped classroom, as mentioned in [43], teachers need to take into consideration three things. Firstly, the engagement of the student’s interests and participation in pre- and postclass activities must be considered. Secondly, the connection between the teacher’s input and the student’s output needs to be equally continuous, critical, and creative. Thirdly, a reflective attitude about the teaching and learning that is taking place and must be done by teachers and students must be adopted.

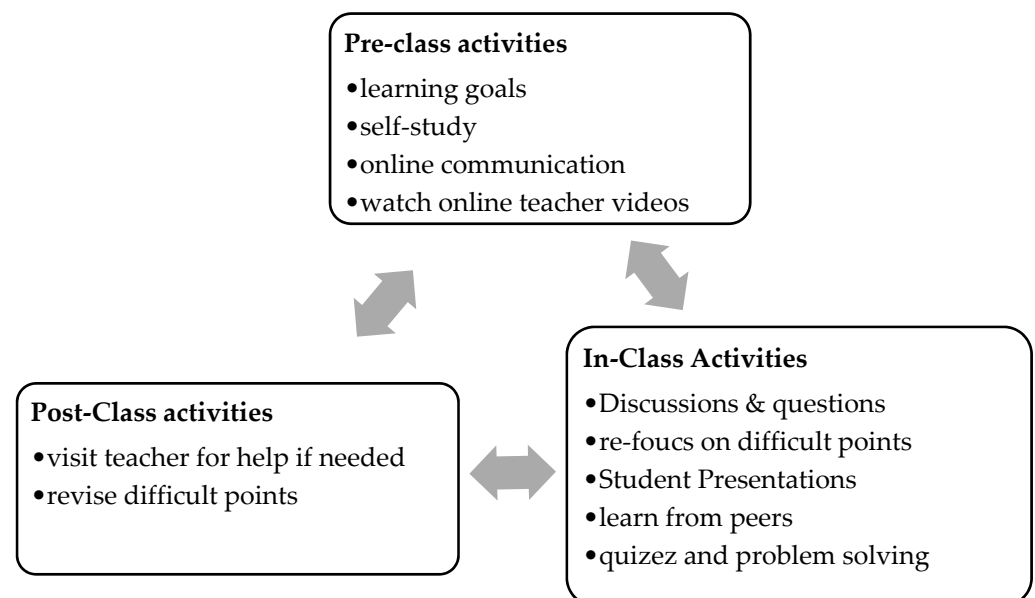


Figure 4. Adapted flowchart for the structure of flipped-classroom settings.

In 2020, the author of [44] tested the flipped classroom effects on online teaching. A total of 39 participants enrolled in this experiment. The research suggested that having a flipped classroom for online teaching is executable. The online teaching activities performed can improve students’ engagement, skills, and knowledge learning. Similarly, the authors of [45] investigated the impact of the flipped classroom on students’ learning. They found improvement in the cognitive learning outcomes, competence, and level of satisfaction of students’ learning outcomes and experiences, with a particular benefit for low-performing students. The authors of [46] categorized the students into low-, medium-, and high-performing groups. The low-performing group was the most encouraged to learn, and was greatly impacted by the class. In 2016, the authors of [47] compared student performance

and perception toward the flipped classroom and blended learning against traditional teaching. The majority of students had positive feedback toward flipped learning and blended learning in concept clarification and exam preparation. However, this study's statistical comparison shows similarities in students' exam grades between teaching with the traditional and flipped method.

5.2. Problem-Based Learning

Problems always boost and stimulate thinking and learning. They motivate our activity and focus our attention [48]. The basis of problem-based learning is to create real-life problems for students to work on solving within small groups [48]. Teachers use problem-based activities to help students develop problem-solving skills, perform deep, active, and meaningful learning, improve research skills, boost creativity, and develop critical thinking skills [49,50]. During these activities, the teacher must be fully equipped with enough skills and tools to stimulate, guide, and make appropriate sources available to the students [49]. However, problem-based learning might not fit all programs [51], as some courses have so much literacy content that problem-based learning becomes more of a distraction than a tool that adds value [52]. The authors of [53] provided some critical factors for the successful implementation of problem-based learning which consists of the problem format and design, the role of the teacher (tutor) as a facilitator, and the assessment strategy. The authors of [49] illustrate the problem-based learning activities process, as shown in Figure 5. The objectives of these activities are to develop problem-solving skills, and after reviewing and assessing experts, this study finds that they agree about the suitability of these activities.

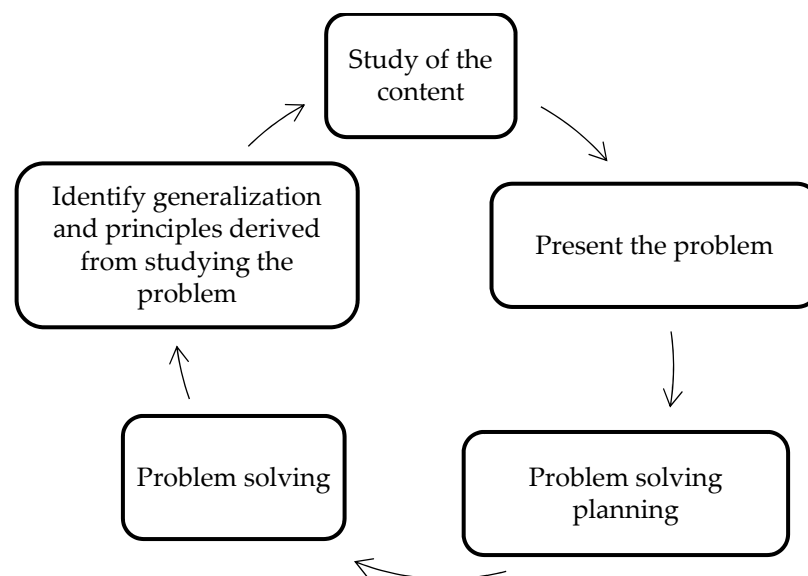


Figure 5. Adapted process of problem-based learning.

In 2015, the authors of [54] tested the impact of the problem-based learning approach as a controlled group postsurvey result. They found that the problem-based learning approach has a significant impact on students' critical thinking and when comparing the critical thinking skills of the students who follow a problem-based learning approach to the students who take conventional learning. They found that the students who used the problem-based approach were learning better. The authors of [55] compared the effect of different mixtures of interactive components (Wiki, Chat) on learning. As a result, the researchers found that wiki has the most positive influence according to the students' ratings compared to chat ratings.

5.3. Gamification

Gamification is a nontraditional teaching approach that facilitates learning, encourages motivation and engagement, improves learner participation and lesson interactivity, and stimulates learners. Proper implementation can lead to the development of students' knowledge and increase their engagement and motivation through competition. For teachers, it is a powerful tool for teaching and assessing students in the educational system [56–59]. Gamification definitely became popular shortly after it initially started simply because most learners love gaming [60], it makes learning enjoyable through competitions, challenges, and rewards [61], and it helps in developing critical thinking and multitasking skills [62]. It makes immediate feedback to students' formative purposes possible through the involvement of features such as scores, badges, ranking, and rewards [58]. Using gamification as a formative assessment tool allows the teacher to acquire initial information regarding each student's learning processes [58]. However, to benefit enough from gamification, teachers must design the games carefully to enhance interaction and active participation, rather than only providing entertainment [63].

In 2018, the authors of [64] provided a gamification design cycle that is shown in Figure 6. The process has six general rules applicable to successfully implement a gamified approach in teaching. In the first step, analysis is required to understand the characteristics and features relative to the setting in which gamification is intended to be employed. The second step highlights defining the problem and designing or building the tool for solving the problem and the means to measure the effects of the involvement. In the third step, the theoretical framework is related to the problem to be solved, and it describes the study-supporting theories. The fourth step involves selecting game elements from a huge available number of games. In the fifth step, the chosen game elements highlight the need for study the problem to be designed and implemented to support the purpose of the involvements, the user experience, the application scenario, and the logic stated in the theoretical framework. The last step evaluates and measures the effectiveness of the involvement.

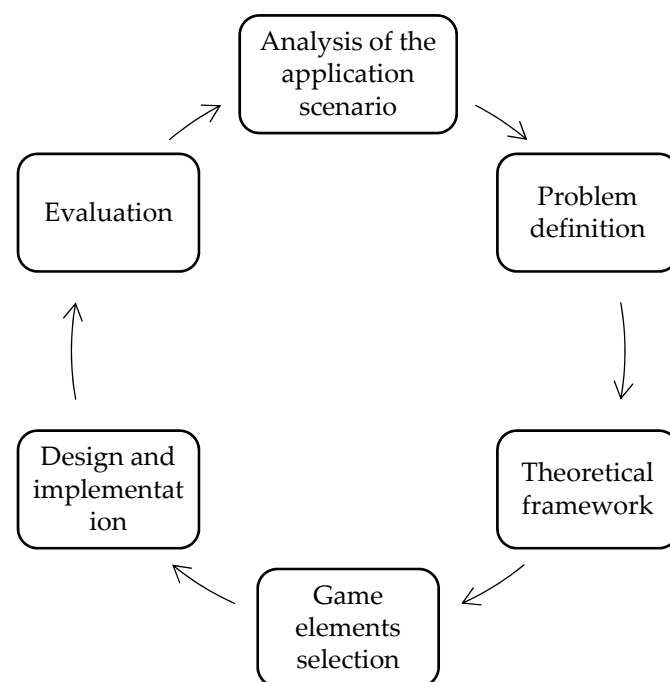


Figure 6. The process of gamification design.

Many studies have been conducted to examine the benefits and effectiveness of implementing gamification. In 2019, the authors of [57] investigated students' academic achievement and engagement through Kahoot and Quizizz as a formative assessment tool

to examine the use of gamification tools that led to any differences in the achievement or the engagement. As a quantitative study result, the authors found an improvement in the students' achievement and engagement. However, Kahoot's impact was significantly better than Quizizz's in visual feedback capacity. Similarly, the authors of [58] investigated students' performance and perceived engagement using Socrative, Quizizz, and iSpring. Two pedagogical interventions were used (paper-based quizzes and gamified e-quizzes) as formative assessments. As a result, both pedagogical methods were effective in assessing students' learning performance. Nonetheless, students were more engaged and competitive in the gamified e-quizzes. Following the pre- and post-tests, the authors of [65] found that students were interested in gamification as a learning tool more than in the traditional classroom, especially regarding the badges element. However, some drawbacks were found due to the internet speed and the condition of the IT equipment.

5.4. Case Study

The case study teaching method is one of the popular nontraditional teaching approaches that allows students to develop and present an in-depth view of a specific situation, event, or entity [33]. This allows teachers to help students to interact with real-life situations to enhance student's critical thinking, insight, problem-solving skills, analysis capabilities, and skills required for decision making [15,66]. The authors of [67] illustrate two ways to use a case study in the classroom. In the first way, students have to read a case study and then describe the nature of the strategy, research, or intervention. Next, students analyze and evaluate the case study content in the situation. At last, students choose among the choices to be discussed in the case study. In the second way, the teacher illustrates problems and limitations in a case study. The students' role is as a consultant in this situation. A class discussion or small team discussion is then required to discuss the options available to solve the problem. The authors of [68] support the latter option, as the students have the advantage of improving their problem-solving skills. According to [69] and as an adaption of [70], a design chart of the case study methodology is presented in Figure 7. It contains four stages. First, the case study design includes the adoption of the required skills and development and review of the case. Second, conducting the case study includes data collection preparation, distributing the questionnaire, and conducting interviews. Third, analyzing the case study evidence includes the analytic strategy used to understand the issues and challenges from multiple perspectives [71]. Finally, developing the conclusions, recommendations, and implications includes evaluating the advantages and disadvantages of the proposed solutions and their impact in the short and long term [71].

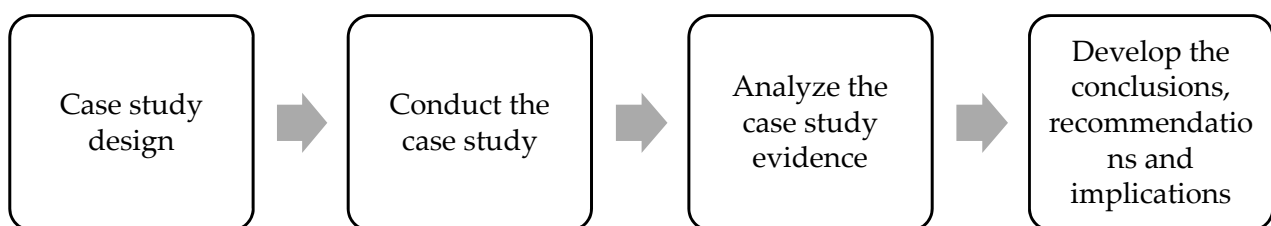


Figure 7. Adapted case study design chart.

In 2013, the authors of [67] investigated students' perceptions regarding the implementation of the case study. The authors found that most students showed a positive perception of using a case study as a nontraditional teaching method, and they were willing to use it in the future. The author of [72] examined students' critical thinking abilities while using case studies. The author found that case studies help students promote active learning and play a vital role in developing critical thinking skills. The authors of [73] examined students' performance regarding conceptual understanding and perceptions while using a case study. As a post-test result of assessing student learning and engagement from cases, they found

improvements in students' conceptual understanding engagement and connections to the real world, and those were significantly better than traditional teaching methods.

5.5. Social Media-Centered

The past decade has witnessed the growth and dominance of social media as a Web 2.0 tool for communication and social interaction with a high degree of participation [74]. Social media or social networking is an interactive Web 2.0 tool that allows users to create, share, and publish information, build communities, and communicate without any boundaries anywhere and anytime [75]. That means that social media has the characteristics of user-generated content, online interpersonal interaction [74], direct communication, users' collaboration [76], and user profiling [77]. Famous social media platforms (e.g., Facebook, Twitter, etc.) are presently being used by universities. Nowadays, each university has a functional Facebook page or Twitter account, but they are still not the preferred choice for educational purposes [76]. We found that Facebook and Twitter use informal learning, while universities do not focus on this kind of learning. Teachers have been using social media to distribute course materials for students and share news and deadlines. Students are now used to exchanging and sharing documents and collaborating with other students independently from the university environment [78]. The famous types of social media and some examples of worldwide used applications are presented in Table 2. The author of [79] illustrates some benefits of these applications as being accessible anytime and anywhere, user-friendly, flexible, personalizable, and enjoyable. The authors of [80] found that implementing social media in education enhances students' engagement and involvement in the learning process, while significantly improving critical thinking skills, self-monitoring of the learning progress, and peer learning.

Table 2. Social Media Types.

Type	Example
Blogs	MicroBlog, Edutopia, Wabisabilearning
Wikis	Wikipedia
Social media network	Facebook, Twitter, WhatsApp
Content Communities	Youtube, TeacherTube, SlideShare

The process flow of using social media in education is illustrated in Figure 8. Teachers first need to choose one of the social media tools to connect and reach students and engage students in collaboration. Secondly, teaching students by presenting teaching materials and concepts in a meaningful way is deemed important. Thirdly, assisting students in reviewing and selecting content and making conversations that guide the learning process is essential. Finally, students need to be notified of deadlines, and providing timely information which guides the learning process is important.

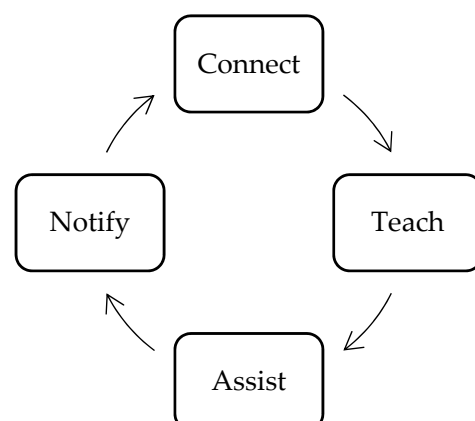


Figure 8. Social media process flow.

In 2018, the authors of [81] observed the use of Facebook and Twitter for the promotion of interest and motivation of students. As a case study result, the authors found that prior to using qualitative and quantitative methods, the tools mentioned are very useful for the communication and dissemination of content outside the classroom. Moreover, the tools are useful for sharing information on applied issues and increasing students' interest and motivation. The authors of [82] observed students' perceptions of using social media in learning. As a study result, they found that the most popular tools used were Edmodo, Google Docs, and YouTube. Students had a better understanding of the topics when using social media tools. The authors of [83] observed the use of social media for academia. The study results show that most academics are already using or willing to use social media. They are aware of the need for a change, and some are working toward involving social media in their teaching. From the students' perspective, social media is good for achievement, improving students' motivation and performance, and increasing classroom participation. The authors assume that using social media will help students enhance their creativity and productivity.

6. PTE Application on Nontraditional Teachings Methods

We offered examples of PTE applications that facilitate the usage of nontraditional teaching methods while teaching students. The structure of the examples is: (i) identify the desired teaching method and its activities; (ii) identify types of tools that can be used with this method (only types, not specific tools); (iii) give examples of specific tools of each of the types identified in the previous point; and (iv) give an explanation of the use of the tools used for each method with the concrete tools proposed. As mentioned before in Section 3, tools are linked to connections and activities, as well as data sources. The below subsections' tables contain tool examples that can also be used as connection facilitators and data sources.

6.1. Flipped Classroom

As mentioned previously in Figure 4, three primary teaching activities, pre-, in-, and postclass activities, are required for successful flipped learning implementation. Teachers require tools to capture, edit, and publish a video in addition to tools for sharing the video with colleagues or finding specific videos in a repository. In Table 3, the authors illustrated some of the available preferred tools needed to be included in the creation of the PTE while using the flipped learning method for teaching.

The proposed PTE examples for flipped learning are as follows, In preclass activities, the teacher first needs to record an educational video through a laptop or mobile phone camera and then save it on the storage of the used camera or save it through the use of Google Drive or others. Secondly, the teacher might need to edit the video to look more professional. Some free tools are available such as Corel and Vimeo or paid tools such as Adobe Premiere. Third, the teacher should publish the final video through some tool such as YouTube or TeacherTube for students to access it or other peers to comment on it for discussion. Further, the teacher may need to expand the reach of the video to share it with social media platforms such as Facebook and Twitter. Next, students may need more help with other videos. The teacher can search and find more illustrating videos that other peers have completed through tools such as Youtube or TeacherTube. This feature can save a lot of time and effort in creating a video from scratch.

In in-class activities, the teacher can build a quiz with tools such as Kahoot! or Quizizz to engage students more in the classroom with a competing leaderboard feature with immediate feedback for the student's scores. The students can then upload an online presentation to share with peers and be evaluated by the teacher. Likewise, the teacher can provide the students a presentation that they can access easily by sharing the link of the presentation with them. Lastly, the teacher can make group discussions through video conference tools such as Zoom or Microsoft teams with the teacher's ability to divide the students into a small working group for a specific task.

Table 3. PTE guide for flipped learning.

Activities	Tool Type	Tool Example	Explanation of Use	References
Preclass Activities	Capture	Android Camera Laptop Camera Zoom Application	Teachers can use these tools to record lectures that highlight critical ideas, explain the subject, and facilitate the pace of a given curriculum map.	[84–88]
	Edit	Adobe Premiere Vimeo Corel VideoStudio	These editing tools are for making videos look more professional by trimming the unwanted parts.	[84–88]
	Publish	YouTube Teacher Tube	These tools work as platforms for hosting videos by uploading them and interacting with the comments of students under the video.	[84–88]
	Find	YouTube Google Search	These tools work as databases of videos that can be useful for the teaching and learning of the teacher and students.	[84–88]
	Share	Facebook Twitter	These tools are used to share videos with students. Teachers need to make it engaging and clear.	[85–87]
In-Class Activities	Quizzes, Questions	Kahoot! Quizzes Socrative	These tools can be used to build a quiz or use an existing one already in the database to make the quiz fun and interactive. Once the quiz code is shared, students can be encouraged to take a quiz during the class.	[84–88]
	Discussions	Zoom Microsoft Teams Cisco Webex	Teachers can use these tools to divide the students into small discussion groups to work on shared tasks. Teachers can start with all students on the same video call, and with a simple click of a button, split students up into small groups to discuss a topic. These tools promote online collaborative learning.	[84–88]
	Presentation	PowerPoint Prezi	Teachers can illustrate the difficult parts through presentation tools and comment on a student's presentation as a feedback feature.	[84–88]
Post Class Activities	Calendar	Google Calendar	Teachers can share important dates and office hours available for after-class questions and discussions with students.	[85,87]
	Chat	Telegram WhatsApp	Teachers can simply ask their students questions to be answered through the chat tools. This function is useful for brainstorming and online exercise activities.	[85,87]
	Material share	Dropbox Google Drive	Teachers can upload all the materials needed for the subject to these tools and share them with students. Additionally, they can edit or delete them anytime, and access students' documents and presentations.	[84,85,87,88]

In postclass activities, the teacher first can use tools such as the calendar to manage the free slots that students can reserve for meeting the teacher offline or online for more explanation of the subject. The calendar can be used for important dates, such as the deadline for delivery of the projects or exam times. Further, chat features can be used for more engagement and connection between the teacher and the students. Applications such as WhatsApp and Facebook Messenger can be a good example for private or group chat. The teacher can use this kind of application to create a group for a specific subject and add the students to this group to give them notices (lecture timing changes, share illustrating videos, share teaching materials, ideas discussions, brainstorming for the next lectures, etc.). Table 3 explains the classification of flipped learning tool types and examples of tools that could be used, and an explanation of how to use these tools in the flipped classroom.

6.2. Problem-Based Learning

Many teachers encourage students to learn through presenting a problem rather than illustrating the syllabus inputs [48]. Real problem solving is the process of giving students the chance to apply an unknown method to a problem that is presented with a specific set of conditions that the students do not know about beforehand to obtain a suitable solution. In this method scenario, the teacher's traditional role changes; the teacher has a role as a facilitator and guide. As one of the main goals of problem-based learning is solving problems, teachers need to guide students during the searching and solving process. The teacher's involvement in asking questions to serve the solving process could improve the students' critical thinking abilities and draw a guideline for better solving the problem. As mentioned previously in Figure 5, some problem-based learning activities need to be performed to achieve the goals of applying this kind of teaching method.

The proposed PTE examples for problem-based learning are as follows. A teacher needs tools to design the problem, and he/she can search online by inserting keywords into tools such as Google, Bing, and Khan Academy. With a lot of results, the teacher can identify the learning issues and can find a lot of ideas. Then, the teacher can organize the collected data in processing tools and design the document as required. Furthermore, the teacher needs to share the document with the students via social media tools or by email. In this step, the teacher can agree with the students about what kind of tool they can communicate in.

Moreover, the teacher may need to split the students into small teams to better guide and assist them. The process of splitting the students can take many forms (the students select the group, the teacher assigns groups, or individually). The teacher may ask the students to make a group through the use of tools such WhatsApp or Facebook groups to communicate individually with each group to assist them by providing videos, documents, or data they may need for solving the problem.

As an observing role for the teacher in this method, the teacher needs to prompt questions, observe students' learning, and give suggestions and feedback. The teacher can provide questions using a document tool or via tools that provide responses interactively and competitively such as Kahoot or Quizzes. The feedback can come immediately to the classroom or social media tools can be used to save time for both the teacher and the students.

Finally, the teacher needs tools to make the assessment. The students in this step need to provide presentations using tools such as Prezi or PowerPoint. The teacher can invite them into a video conference to present their work and the students can receive comments and give feedback to the teacher or other colleagues during the session to gain more experience and ideas.

Table 4 provides the classification of problem-based learning tool types, some of the available preferred tools that need to be included in the creation of the PTE while using this method for teaching, and an explanation of how to use these tools.

Table 4. PTE guide for problem-based learning.

Activities	Tool Type	Tool Example	Explanation of Use	References
Define the problem and identify learning issues	Search	Google search Bing Khan academy	Teachers can use these tools to search for information regarding the problem design.	[89–91]
	Processing	Word Google docs	Teachers can use these tools to write down the problem description and identify the learning outcomes. Moreover, they can read and edit students' work on the same tool.	[89]
	Presentation	PowerPoint Prezi	Teachers can illustrate the problem, the materials required to follow through with presentation tools, and comment on student's presentation as a feedback feature.	[89,91]
	Share	Facebook Twitter Mail	Teachers can share ideas with the students' groups and comment on their questions.	[89,91]

Table 4. Cont.

Activities	Tool Type	Tool Example	Explanation of Use	References
Divide students into groups or individuals	Material	Dropbox Google Drive	Teachers can use these tools as free online tools to save the data needed for facilitating the process of solving a problem. They can also share docs, presentations, audios, and videos with students via two-way communication.	[89,91]
	Resources	MERLOT YouTube Khan academy	Multimedia teaching and learning repository, loaded with a lot of material that can be offered to students to aid with the solutions.	[89,91]
	To-Do List	Microsoft To Do Google Tasks	These tools help teachers and students focus on the target and be aware of the deadlines.	[89]
	Discussions	Zoom Cisco Webex Blogger	Teachers need to observe students' discussion meetings or blogs to support them and guide them through the learning process. Zoom and Cisco are free tools for online video conferencing. Blogger can help the teacher reach students' discussions and brainstorming posts.	[89,91]
	Chat	Messenger WhatsApp	For immediate help, these tools are freely available to chat with students' teams, and teachers will observe so they can answer questions.	[89,91]
Creating questions Observe students learning to make suggestions Give feedback	Questions	Kahoot! Quizzes Socrative	Teachers can use these tools to understand students' knowledge during the learning process to make sure that they are on the right track.	[84,89,91]
	Brainstorming Mind Maps	Ideaboardz Mindmap	Teachers can aid problem-solving mind maps of students to help them represent their thinking and to make it easier to observe students' thinking, as it facilitates the brainstorming process by visualization. It plays a vital role in the analysis of the problem and the identification of potential solutions.	[89,91]
	Flowcharts	App. Diagrams Lucidchart	Teachers can aid flowcharts of students to illustrate what happens at each stage of the problem-solving process and how each event affects other events and their decisions.	[89]
Assessment of the students	Presentation Discussion	Prezi Zoom	Teachers can use these tools for formative and summative assessment of students by presenting the work and discussing the alternative solutions.	[89,91]

6.3. Gamification

In recent years, gamification has taken the world of education to the next level in. The goal of utilizing gamification in education is to increase student engagement, competition, and learning by including game-like learning elements. To build effective games, teachers need to identify a series of goals, clear rules, elements of a story, high interactivity, and continual feedback, including some kind of reward. The teachers may include social elements of teamwork and communication. Involving games in the teaching and learning process can enhance student focus, critical thinking, and motivation and allow students to try, fail, and explore. The gamification method also includes points, leaderboards, direct competitions, and stickers or badges, allowing teachers to engage students and make them excited about learning rapidly. As mentioned previously in Figure 6, the teacher needs to follow some rules to implement gamification successfully.

The proposed PTE example for gamification is as follows. The teacher needs to define the problem and the game elements that can be included to serve the process and set up the points system. In this step, the teacher needs tools to search for questions using online tools such as Google or Bing or using the question bank provided by the institution he/she worked in. The teacher can select the questions that are required to test students' learning with the help of processing tools such as Microsoft Word or Google Docs. The teacher sometimes does not need to repeat the process, and only retrieves custom questions previously completed and saved in one of his/her tools such as Dropbox.

Moreover, the teacher needs tools to design the game and game elements. With the help of available interactive question tools such as Kahoot and Quizizz, the teacher could make the process more fun for the students. After finishing building the questions, the teacher needs to deliver the quiz or the assignment to the students; with help of social

media tools, the teacher can share the link of the quiz or in the classroom by a QR code that most of the tools provide.

Furthermore, the teacher needs to observe the process of solving the questions. With the help of video conferencing tools and the time limit feature in the Quizzez tools, the observation role could be easier. Sometimes students need to chat with the teacher to illustrate the hard questions. They can use the feature of raising hands available in most video conferencing tools, or by chatting privately with chat tools.

Finally, the teacher needs to assess the students and give them feedback. By using the quiz's tools, the assessment can be immediate and automated. The teacher can collect data about the questions that the students fail to answer most to help with future planning and give more data to students to revise using processing tools, video tools, etc.

Table 5 below shows the classification of gamification tool types and some examples of the available tools needed to be included in the creation of the PTE, and an explanation of how to use these tools in the flipped classroom.

Table 5. PTE guide for Gamification.

Activities	Tool Type	Tool Example	Explanation of Use	References
Problem Definition, describe the game elements and set up a points system	Search	Google Bing	Teachers can use these tools to search for information regarding the design of the game.	[92–94]
	Processing	Word	Teachers need to write down the ideas and the planning required to build the game, collect all found data and information in a document file to see the whole image of the description of the game elements, and set up the goals.	[92–95]
	Retrieve	Dropbox Google Drive	Teachers may use these tools to retrieve a previous game design or data that they might need while building the new game.	[93–95]
	Discuss	Blogs Facebook	Teachers may need the help of peers and teachers that use the same methodology. They can do that with the help of finding a Facebook group or a blog that shares some information about the subject that the teacher is trying to build.	[92–95]
	Resources	Khan Academy Question banks YouTube	These tools provide teachers with many resources, materials, videos, and questions that may help in the planning of the game design. Teachers can also provide their students with such resources for preparing them for the quizzes and a better learning experience.	[92–95]
	Calendar	Google Calendar	Teachers can share the important dates of upcoming assignments, quizzes, or exams with students.	[93,94]
Design the game and select the game elements	Create, Edit	Kahoot! Quizizz Socrative GimKit	For creating the game, teachers need the help of some free tools built for gamification. These tools use music, images, and a colorful interface to get students excited about the task at hand. Some tools such as Kahoot! allow teachers to include YouTube videos to add some information to each question. Each question may have a timer or a stopwatch.	[92–95]
	Share	Facebook Twitter WhatsApp	Teachers can share the QR code or the link of the quiz with students so they complete them at a specific time.	[92–95]
Observe and communication	Chat	Zoom Microsoft Teams	Teachers can use gamification in class or using online tools such as Zoom to facilitate the reach for all students.	[92–94]
Assessment and Feedback	Capture Analysis Scores Rewards Grading	Kahoot! Quizizz Socrative GimKit	These tools allow students to receive points for every correct answer and also receive extra points for answering faster than others. Teachers can use the leaderboard and the analysis that tools create to grade the students and reward them.	[92–95]

6.4. Case Study

The use of case studies can be a very effective classroom technique, as in some scenarios, students learn better from examples than from logical development by basic principles. Teachers may use case studies with students to explore what they have learned by applying them to real-world situations. The cases can either be simple or complex, depending on the subject's objective. The teacher asks questions with a detailed description of a situation with data to analyze. Usually, the teachers' assigned cases require students to answer an

open-ended question or develop alternative solutions to an open-ended problem. The answer may vary for the structure of the case. It may be a small essay or group work with a plan and a decision. The cases are one critical component of teaching with this method, but also, the teacher needs strategies and tools to manage a case study effectively [96]. As mentioned previously in Figure 7, teachers need to follow the design process to implement the case study successfully.

The proposed PTE example for a case study is as follows. The teacher first must identify a problem to investigate. Teachers commonly begin by making students read the case or watch a video that summarizes the case. In this step, a lot of work is needed by the teacher. The teacher can search cases through specialized tools in cases such as thecasecentre.org or by recording a video illustrating the case, or by finding a premade video. Further, teachers need to set milestones that define what students should accomplish to help them manage their time. The teacher can do that by using to-do list tools or calendar tools. The teacher can help students by providing them with some tools that have some resources that they can use during the case solving.

Moreover, the teacher can observe students' learning with the help of writing check tools and plagiarism check tools to assess the students' work to improve the learning process. Students usually work in small groups or individually to solve a case study. During the case process, the teachers should guide and assist the students with immediate feedback by providing them questionnaires, surveys, and chats through the chat tools or by discussing using discussion tools such as blog tools.

Furthermore, the students need to present the solutions they achieved through the use of presentation tools. At the end of each work period, the teacher will assess the students' writing, considering what they have completed and what they have not with a clear rubric. Moreover, some interviews and discussions with the students will improve their learning experience in this case. The use of tools for questions and rubrics is a good choice for this method.

The below Table 6 shows the classification of case study tool types and some examples of the available tools that can be included in the creation of the PTE, and an explanation of how to use these tools.

Table 6. PTE guide for case study.

Activities	Tool Type	Tool Example	Explanation of Use	References
Identify a problem to investigate	Search cases	thecasecentre.org apus.libanswers Google Bing	The problem should be challenging and complex enough to yield multiple solutions. The teacher can search these databases for ideas and useful information.	[66,72,73,97,98]
	Video illustrating	YouTube TeacherTube	Teachers can find or record a video and upload it to these tools that illustrate the problem in hand to students to summarize the case.	[66,72,97–99]
	Processing	Google docs Word	Teachers can use it to observe and correct student's mistakes in their documents.	[66,72,98,99]
	To-do List Calendar	Google Calendar	Teachers will need these tools to identify the case milestones for the students. Additionally, teachers can share with students the critical dates and office hours available for questions and discussions	[66,98,99]
	Resources	Encyclopedia	It consists of a massive amount of data that can be useful for writing a case study analysis.	[66,72,98,99]
	Share	Facebook Twitter WhatsApp	Teachers can use these tools to share essential data regarding the case (e.g., videos, documents, and useful websites)	[66,98]
Observe students learning	Writing check	Grammarly	This tool can help a lot at the stage of writing a text. The teacher can use it both ways for checking his/her mistakes and while assessing students writing with many suggestions.	[66,97,98]
	Plagiarism check	Quetext	Teachers may use this tool to check for plagiarized content.	[66,73,98,99]

Table 6. Cont.

Activities	Tool Type	Tool Example	Explanation of Use	References
	Surveys Questionnaire	Google Form	Teachers can use surveys for collecting important feedback from students and to check the results collected by the students according to their proposed solutions for guidance.	[66,73,98,99]
	Interview Discussion Chat	Zoom Blogger WhatsApp	Teachers can use Zoom as an interview method. Teachers can extend the discussion by commenting and asking questions in blogs or Facebook groups. Alternatively, they can use a quick chat to guide the group on a specific topic.	[66,72,73,97–99]
Presenting solutions and assessment	Questions	Kahoot! Socrative	Teachers can make the presentation of the work funny by starting with answering questions using gamification tools such as Kahoot!	[66,72,73,97–99]
	Rubric	Quickrubric rubric-maker iRubric	These tools are a scoring guide used to assess the quality of students' constructed responses. Teachers can use them for the formative or summative assessment of the students.	[66,73,98,99]

6.5. Social Media-Centered

Social media has changed the way people communicate and share information in their personal and professional lives. It can also be used in the classroom setting to facilitate the reach of students and peers. The possibilities for social media tools in the classroom are massive. Social media is an area that promotes collaboration, active engagement, and increases learning by building on existing connections outside of the classroom [100]. Social media as a teaching tool can engage students in creative ways, encourage collaboration, and boost discussion among even quiet students [101]. Students can access, review, and comment on each other's assignments, work in teams to create content, and the teacher can ask questions or start a discussion. Additionally, the teacher can communicate with peers for professional development [102]. As mentioned previously in Figure 8, teachers need to follow the process of social media to understand what tools are necessary for a successful social media implementation.

The proposed PTE examples for social media-centered is as follows. The teacher first needs to create his/her teaching network. Through the use of social media tools such as Facebook, Twitter, blogs, Research Gate, and LinkedIn, the teacher has access to many users with the same interests or even with new interests that can help the teacher in teaching development.

Further, in using this method, the teacher should create and publish content. Content creation can include blog posts, videos, or conference and journal publications. Following content creation, the teacher should publish and share the contents with the students or peers.

Moreover, the teacher needs to listen to and answer the targeted audience. This can be accomplished through the use of a conversation or discussion between teachers and students or teacher peers. Teachers need to be prepared to listen to their answers and engage with them.

The final step in this process is content comparison and analysis. In the final step, the teacher needs to carefully analyze the results to learn and improve. Some social media tools such as Facebook and Twitter have features that can automate the analysis of the responses and the results with charts for easy understanding.

Table 7 provides the classification of social media tool types and some examples of the available tools needed to be included in the creation of the PTE, and an explanation of how to use these tools.

The use of social media tools can vary between teachers' personalities and familiarity with the tools. Teachers can use Facebook pages to broadcast updates and alerts. Others can use Facebook groups to stream live lectures and host discussions. Teachers can use Twitter to post notices for assignment due dates and helpful links to practice quizzes or downloadable resources. They can also create discussions, create a hashtag for chats, and

create a class blog for discussions using different available platforms, such as WordPress, Wix, or Blogger. The course syllabus and any assignments, updates, and resources can be shared on a blog, and blog posts can be assigned as essays for students.

Table 7. PTE guide for social media.

Activities	Tool Type	Tool Example	Explanation of Use	References
Teaching networks	Connect with peers	Classroom 2.0	Teachers can connect through using Classroom 2.0. It is a social network for teachers. Teachers can chat, send messages, and exchange ideas on how to best teach students.	[82–86,89]
		Academia.edu ResearchGate	Teachers can use it to connect with peers whose primary goal is to share research papers or follow researchers to read their new research or to collaborate.	
		LinkedIn	A professional social forum for searching with the same interest for potential collaborations. Teachers can message the targeted person through their profiles.	
		VoiceThread	Teachers can upload and share images, videos, and documents with students or peers. Teachers can have an online conversation about each other's posts through audio, video, or text comments.	
Create and publish content	Capture	Android Camera Laptop Camera Zoom application	Teachers can use these tools to record lectures that highlight critical ideas explaining the subject.	[82–84,86]
	Publish	YouTube TeacherTube Vimeo	YouTube has a special section dedicated to teachers and how to teach with it. TeacherTube has tabs for documents and audio, and they are one of the more useful resources within it.	[82–84,86]
	Share	Facebook Twitter Instagram	Teachers can use these tools to share created content with a group of students.	[82–84,86]
Listening and responding	Read and comment	Facebook Twitter Instagram Blogger YouTube	All the social media tools now can connect and communicate through many features such as commenting and liking posts and sharing. Teachers can use these features to reach and comment on posts that need collaboration.	[82,86]
	Dashboards	TweetDeck	With this tool, teachers can view multiple timelines in one easy interface, schedule tweets for posting in the future, and build tweet collections.	[84,86,89]
	Video conferencing	Zoom Application Microsoft Teams	Teachers can use these tools to discuss with peers or students.	[84,87]
Content analyzing and comparing	Charts Data analysis	Facebook page analysis	Teachers can create a page to see the students' engagement and analyze the views and comments among the different posts for future improvements.	[84,86,91]

7. Conclusions and Future Research

This study had three primary goals: (1) to identify the structure of PTE and how it works; (2) to identify the advantages, frameworks, and successful implementation stories of nontraditional teaching methods'; and (3) to categorize the tool types of nontraditional teaching methods to serve PTE applications.

The results revealed that the concept of Personal Teaching Environment (PTE) can facilitate a teacher's fulfillment regarding their educational tasks. The authors summarized the technical approaches for establishing PTEs, their frameworks, and their components (tools, connections and activities, and data sources).

We conclude that we form a review as a roadmap for the creation of PTEs with several tools based on the specific needs of each teacher. We focus on how to assist the teacher

while using one of the five identified nontraditional teaching methods. We established significant examples of PTE applications through activities, tool types, examples of tools, and examples of the use of such tools according to the selected five nontraditional teaching methods. This involves the teacher in the students' formal and informal learning.

The study contains some limitations. The first one observed is that the keywords used to collect an inclusive database may not be extensive enough. However, the authors are confident about the number of scholarly works collected. Secondly, this study identifies some of the nontraditional teaching methods to adapt them to a Personal Teaching Environment. However, other nontraditional teaching methods were not studied. Third, some of the databases were not included in our search (i.e., Web of Science and SCOPUS).

Future studies could investigate the use of PTEs with other nontraditional teaching methods not targeted in this study to identify the advantages and impact of using such techniques for teaching. Furthermore, we consider it important to test the implementation of the PTE framework in a running course to analyze its impact on the overall educational experience.

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