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Research Paper

A review of gamified techniques for foreign language learning

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Abstract. One of the undemanding privileges of the learners in the 21st century is the ability to learn foreign languages. With time, the domain of Foreign Language Learning (FLL) has become more technology centric. Wherein, the learners are digital natives who grew up with digital technologies and familiarity with the different learning mechanisms. The FLL introduced a new notion to motivate learners in their pursuit of achieving lingual fluency. A concept adaptable to modern-day learners passionate about learning a second language is 'gamification.' Gamification refers to "the use of game elements and game design techniques in non-gaming contexts." Gamification seeks to motivate learners by incorporating various game elements in the learning environment. Initially, this work highlights different research contributions to the domain in the literature review section that utilized gamification to enhance FLL. Later, it conducts a comparative study of gamified techniques based on five parameters; game mechanics, design model, augmented reality, student tracking mechanism, and interaction methods. The parameters mentioned above are specifically chosen to clarify the relative strong points in each technique, and also to find common characteristics among them. Gamification plays a definitive role in motivating second language learners (SLLs). It is a challenge to decide which gamified technique is apt since each one of them presents several features enabling a particular learner and also inapplicable features for others based on the learners' background, abilities, and requirements. This work might serve as a basis for researchers concerning the improvement of FLL via gamification. Also, it facilitates the selection process of a gamified technique resonating with the students' needs and preferences. Besides, it scales the horizon of opportunities in finding a new technique to simplify the FLL.

Keywords: Language learning, gamification, motivation, engagement, game elements.

INTRODUCTION

The community looks at learning as a critical element contributing to a better quality of life. Currently, the conventional learning concepts and mechanisms no longer suffice in the new social requirements of the fast-growing knowledge (Radovan and Perdih, 2018). The appearance of new Information and Communication Technologies (ICTs) has to lead the way to all kinds of professions, from medical to educational domains. Thus, learning now requires more efficient and Interactive Learning Environments (ILE) (Goh *et al*., 2019).

Given the astounding success of the gaming development industry, social media, and decades of study in human psychology, instructors have made unprecedented efforts to incorporate games in the literary domain to augment the motivation and engagement aspects of learners(Figueroa-Flores, 2015). A novel way of employing games into the classroom is called "gamification." Gamification means "the use of game elements and game design techniques in non-game contexts" (Garland 2015). Primarily, gamification aims to

escalate the engagement of people and motivate them through various reward elements such as badges, positions on leaderboards, feedback, and braving the game levels. Thus, creating a sense of victory, empowerment and commitment to the progress in achieving the game milestones.

Gamification is the pursuit of applying game mechanics and design elements in non-gaming contexts to enable an elevated level of user engagement. The need for it exists in different contexts such as employee motivation, understanding complex concepts such as energy preservation, heat, comprehend diseases, create healthy competition, business requirements, and personality development. Moreover, Gamification has become a broad topic of research, debate, and application in the education field. The aim of incorporating Gamification towards education is to manifest an engaging and useful learning experience. It is noteworthy that integrating game elements (e.g., levels, badges, contests, leaderboards, and points) with education plays a pivotal role in motivating the learners in achieving educational objectives. From the learner perspective, the educational objectives are challenges required to be achieved to pass through the academic levels. The challenges and progress of learners during academia contributes to the learning outcomes.

Currently, learning a foreign language is witnessing an unanticipated demand, as technology effectively quashes the geographical boundaries by allowing access to information and people, globally. Gamification provides means for foreign language educators to design a significant language learning experience and reasonable fluency levels. For instance, by applying educational gamification, the foreign language learner could be seen as a player zealous of completing a level in a game.

Learners tend to feel more engaged and motivated in educational gamification of the Foreign Language Learning (FLL) process. Accordingly, the tutors can deliver instructions via a gamified shared vision, and also increase the time dedicated to the learning tasks depending on the difficulty level to achieve the required fluency. Motivation is elevated substantially in a gamified learning environment where the learner's accomplishments are announced publicly through a reward system of awards, prizes, or badges. For example, the implementation of badges can serve as a motivational tool in the FLL environment. Also, it could serve as a formative assessment by setting standards for the challenges that the learner faces to achieve fluency in FLL (Figueroa-Flores, 2015).

This research work reviews different gamified techniques existing in the literature used to enhance FLL such as; Augmented Reality (AR), mobile and place-based language learning tool (i.e. Explorez), Expert Point Cloud ($EP) recognizer algorithm, gamification framework, gamified application (i.e. playful frame), gamified instructional unit (i.e. Vida Perú), course level gamification, paper-based gamified curriculum as well as gamification in mobile apps dedicated to FLL. Later, it conducts a comparative study among these gamified techniques based on five parameters are game mechanics, design model, augmented reality, student tracking mechanism, and interaction methods. Such parameters are chosen to clarify relative strong points in each technique and find common characteristics among them. As a result, gamification plays a definitive role in motivating Second Language learners. It is not possible to decide which gamified technique is the best since each one presents several features valid for a particular learner and inappropriate for another depending on his background, abilities, and requirements. This work might serve as a basis for researchers concerning the improvement of FLL via gamification. Also, it enables in selecting an appropriate choice in sync with the requirements. It also scales the horizon of opportunities in finding a new technique to simplify the FLL.

The remainder of the paper is structured as follows: Section 2 offers a review of the gamification techniques to improve foreign languages' learning processes found in the literature and highlights the research based on such techniques. Section 3 indicates few related works. Section 4 expounds the comparative analysis. Section 5 discusses the efficiency of the described gamified techniques on the learning outcome. Lastly, section 6 concludes the paper and hints at the possible future works in the FLL domain.

GAMIFICATION TECHNIQUES OF THE FLL

The literature review indicates remarkable efforts in integrating gamification with other techniques in an innovative approach in improving the Foreign Language Learning. Based on game mechanics, gamification seeks to motivate learners. This section highlights the gamified techniques utilized to improve FLL. Augmented Reality (AR) implies the technology that blends the representation of real elements with virtual elements in a real environment. Explorez is a first place-based gamified learning tool directed towards the procuration of French language skills. Expert Point Cloud ($EP) Recognizer is an algorithm developed for the calibration of writing Japanese letters by comparing the learner input with the created datasets. The gamification framework is a framework that uses gamification in Massive Open Online Courses (MOOCs) to boost Chinese language learning and Chinese culture. The playful frame is a gamified application designed to facilitate learning French as a Foreign Language class in a Norwegian upper secondary school. Vida Perú is a gamified instructional unit that aims to learn Spanish as a Foreign language through integrating the technology into the curriculum. Course Level Gamification exposes an example of integrating gamification in Teaching English as a Foreign Language

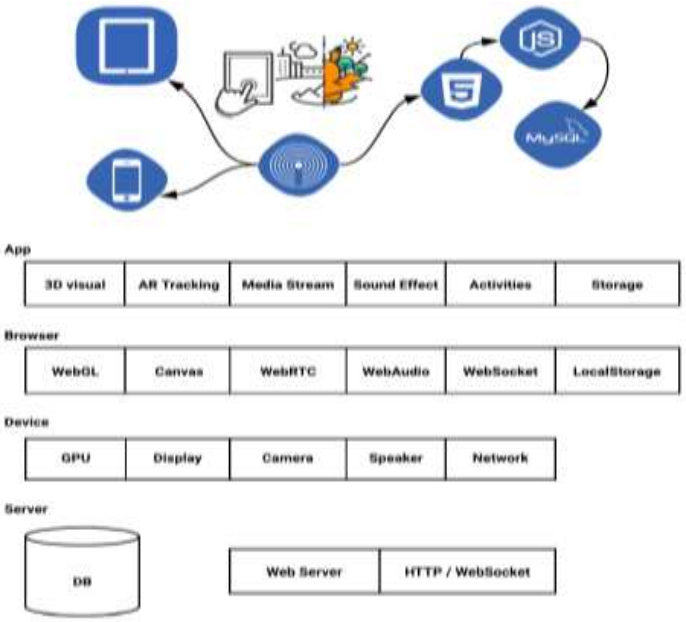

Figure 1. Infrastructure diagram of GaMbAR.

(TEFL) course in Japan.

In contrast, a paper-based gamified technique confirms that gamification does not require digitalization, where the same basics of playfulness can be used in different approaches to facilitate teaching English-as-a-foreign-language. Finally, gamification in Mobile Apps adopts mobile technology and gamification for language teaching and learning. This section illustrates such techniques.

Augmented reality (AR): GaMbAR

Augmented reality (AR) allows the blending of the real elements with virtual elements such as text, sound, image, 3D objects, or animation. Mainly, the AR system combines real and virtual objects in a real environment. It enables interactivity with animated objects in real-time. AR also aligns real and virtual objects with each other (Hancock *et al*. 2008).

However, AR technology is not a new concept. It has its abundant history of applications in the fields of military, medicine, robotics, engineering design manufacturing, learning, entertainment, maintenance, and repair. AR displays information using virtual objects that a user cannot analyze through its senses of touch or vision. AR enables people to interact with the real world innovatively and flexibly. Additionally, the graphical features of virtual objects (e.g., position and shape) can be changed via interaction techniques of AR. In the educational field, numerous research works found that using AR in learning can significantly increase the motivation, resulting in reinforcing students' correlation to the learning activity and learning achievements (Slijepcevic, 2013; Ibáñez *et al*., 2015; Küçük *et al*., 2016; Chang, 2015). Moreover, utilizing gamification and augmented reality in learning activity improves motivation and increases the realization of learning materials (Kesim and Ozarslan, 2012).

According to Katiyar *et al*. (2015), there are two types of simple augmented reality viz, marker-based AR and marker-less AR. Marker-based AR utilizes cameras and visual cues. Different types of augmented reality markers are images that can be discovered via a camera and are used by the software. For instance, the position of virtual assets existing in a scenario where most of the assets are black and white colors. The colors are used to represent the contrast for the assets that cannot be detected by the camera with precision. Black and white images composed of two-dimensional (2D) barcodes are an instance of the simplest types of augmented reality markers.

On the other hand, marker-less AR uses positional data such as a mobile's GPS and compass. The image collected through the internet (e.g., can be collected using GPS) and displayed at a specific location. It does not require a marker to present the content. Marker-less AR is more interactive than marker-based augmentation. In the context of FLL, a gamified mobile learning system, GaMbAR, was developed in Salman (2017). It utilizes AR (i.e., marker-based AR) to support the learning activity. The GaMbAR infrastructure diagram is shown in Figure 1.

For the back-end, GaMbAR uses MySQL to retain the data, and Node.js to serve application content. GaMbAR is implemented using standard HTML5 web technology to ensure platform independence. Also, HTML5 reduces cost and time in development and ensures sustainability.

Figure 2. (a) Character in the coffee quest; (b) Map accessed by the users in the 'Coffee quest'.

Although GaMbAR is a web-based application, the plurality of load tasks from the game itself happens at the local device. Moreover, GaMbAR uses the HTML5 API in the browser engine to connect with the I/O device of the learner and processing unit desired by the system such as device's GPU, speaker, camera, display, and an enjoyable multimedia learning experiences.

GaMbAR learning system can be run using only the Chrome browser on Android devices. It suffers performance bottlenecks on iOS platforms due to HTML5's WebRTC. Also, GaMbAR cannot be run using Firefox in Android, due to a bug that flips the camera upside down when streaming the video.

GaMbAR developed system tested in a case-study related to learning French vocabularies as a foreign language in Indonesia indicated that utilizing AR in gamification can enhance student's motivation and increases the sense of achievement in gamified learning.

Mobile, place-based language learning tool: Explorez

In an attempt to develop a system similar to Mentira (project launched in July 2009), which was the first mobile, location-based, augmented reality learning tool directed towards improving Spanish language skills (Holden and Sykes, 2011). It took place in Los Griegos, a Spanish-speaking neighborhood in Albuquerque. The chief mechanics of the game is a text-based, Spanish-language conversation among the player and fictional characters related to the murder and its solution. Such interactions forms in a branching dialogue where the player chooses what he or she would like to say as part of the conversation. Each choice of 'where to go,' 'what to do,' or 'what to say' can lead to an event. Extensive research has been conducted to create the tool (Holden and Sykes, 2011). This research has resulted in a gamified learning tool called Explorez (Perry, 2015).

Explorez is a first place-based gamified learning tool directed towards the procuration of French language skills. It is a virtual fictional treasure hunt. The player in Explorez acts as a personal assistant to a famous French personality. This famous might be an actor, musician, politician, or any other celebrity depending on the personal preference of the player.

To attract the largest possible demographic, Explorez uses a set of game-elements viz avatars, quests, and badges. Players interact with virtual characters. These characters direct players or give them quests with clues to reinforce the storyline. Interactions might be a form of video and audio recordings or written text, which the student responds to. Such interactions allow students to improve input and output language skills, including oral and written.

Moreover, quests composed of varying challenges like collecting virtual objects, taking pictures of particular objects, and explore locations on the map. The challenges involve a diversity of options from which individuals or groups can choose. Figure 2 shows a screenshot of the (a) character in a coffee quest, and (b) map players see in the coffee.

Mainly, Explorez was developed for first-year university French students to find a link between gaming and education via quest-based learning and augmented reality. Based on GPS, Explorez converts the University of Victoria, B.C. campus into a virtual francophone world in which students interact with items, characters as well as media in an attempt to improve their French language skills and explore their campus. The University of Victoria is not a francophone campus; It is transformed into a virtual francophone environment through Explorez.

During testing Explorez, some technical issues have appeared like WiFi disconnection and freezing the system suddenly, which did not provide an accurate

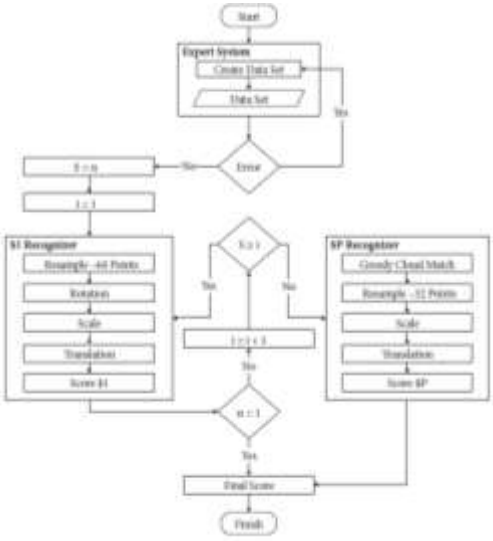

Figure 3. Expert Point Cloud recognizer algorithm.

judge on its performance. Further assessment is required to analyze students' interactions with this tool and whether it has achieved the goal for which it was designed (i.e., improving French language learning)

Expert Point Cloud ($EP) recognizer algorithm

A brief overview of algorithms that $EP based caters ease to the full depth analysis and understanding of Expert Point Cloud.

Unistroke ($1) recognizer: 2-D gesture

The recognizer algorithm intended to read patterns speedily. It can only be used to read a single pattern (stroke), or it can be said to have 2 permutations. $1 algorithm has two characteristics viz-a-viz rotation invariant and size invariant. Rotation invariant is a pattern created by the tendency of an angle formed by the user; if this pattern is consistent with the formation order of the same pattern, it produces the same reading. Size invariant is a pattern created with a particular size formed by the user. Through size invariant, reading performed by modifying the size of the data created, resulting in the same reading.

Point cloud ($P) recognizer: 2-D gesture

The stroke-gesture recognizer algorithm augments the prototyping of gesture-based user interfaces. $P has two characteristics are the size invariant and direction invariant. The size invariant of $P is the same as $1. The direction invariant is a pattern created in a different order that results in the same reading.

The method of writing letters is a pivotal issue while learning the Japanese language. The reason goes back to that the process of writing Japanese letters indicates the balance and precision of writing someone. Thus, it requires a method that can read the process of making Japanese from beginning to end. Hence, the $P algorithm was improved into an Expert Point Cloud ($EP) recognizer (Udjaja, 2018).

Initially, datasets were used as an assessment tool for the learning process. These datasets are formed by projecting the initial process of line formation to create the final form of a point. These datasets are stored in the XML format, including the position (x, y) of the writing.

In general, $EP algorithm is used for the calibration of writing Japanese letters since it compares the player input with the created datasets. $EP cloud recognizer algorithm is illustrated in Figure 3. It is a combination and amendment of both expert system methods and unistroke ($1) recognizer from Wobbrock *et al*. (2007), and point cloud ($P) recognizer from Vatavu *et al*. (2012).

The expert system is responsible for making the Japanese recognition system sequential. Hence, the writing process from beginning to end could need to be done appropriately.

Unistroke ($1) recognizer algorithm model consists of five consecutive stages which are resample, rotation, scale, translation, and score. The resample stage asks the player to create a Japanese letter and processes the player's input to check whether the language is correct or not. After that, it changes the player input to N point according to the writing coordinates. Then, it calculates a distance among all points of the letter and specifies the midpoint of writing. The N-th distance is divided into 64 points. The rotation stage performs a withdrawal line from the midpoint of the writing to the starting point. Next, it determines the angle θ and implements the rotation on the x-axis until the angle amount to the angle of 0°. The scaling stage is performed to specify the equalization of the large or small size of the player input to the existing dataset. The translation stage determines the center point of the player writing and dataset. Finally, the scoring stage computes the accuracy ratio of writing. After all, strokes formed into a letter, the Point cloud recognizer ($P) algorithm model is applied to detect writing as a whole. The $P algorithm model does not differ too much about the $1 model. It consists of the same resample, scale, and translation stages. The difference lies in that the N-th distance here is divided into 32 points and computed using a greedy cloud match. Greedy cloud match looks for a minimum distance among input player and datasets. The $P does not include the rotation stage. Score Final phase assesses the overall accuracy of the player input following the datasets.

$EP algorithm applied in the RPG game gauges the writing precision of Japanese letters. In the RPG game, the battle system is user turn-based and has an Active

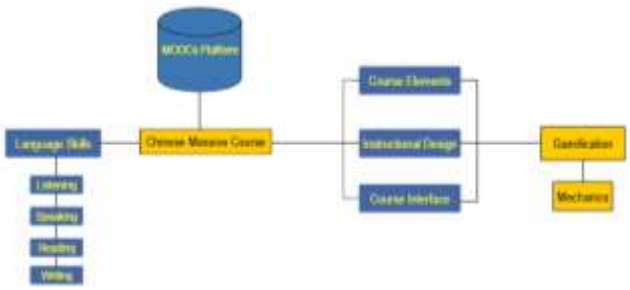

Figure 4. Practical framework of gamification in MOOCs to support Chinese language learning.

Time Battle (ATB). Initially, the player and enemy alternately attack based on the ATB specified. To attack, the player writes the Japanese language correctly followed by, the enemy — the damage on both sides is at an encore with the accuracy of writing. Resultantly, using the $EP recognizer algorithm in the attack system of the RPG game along with the turn-based and ATB can entice players to learn how to write Japanese.

Gamification framework

Massive Open Online Courses (MOOCs) is a platform containing a plethora of courses in several domains, including foreign languages, available for global learners. These courses are built using different open educational resources. MOOCs are a potent tool for self-organizing learners; wherein everyone can study courses for free. Learners need to create an account at the MOOC platform and go ahead in learning. Learners may get a certificate upon completion of a course. MOOCs support communication among the massive number of learners by using available social interaction tools and course platforms. Moreover, MOOCs provide several capabilities such as sharing resources, supporting activities, collaboration, and means to track learners' achievements and interactions. Therefore, the implementation of gamification in MOOCs has great significance. There have been several studies on using gamification in MOOCs (Mesquita *et al.*, 2014; Reischer *et al.*, 2017; Metwally and Wang, 2017; Martinez-Nuñez *et al*., 2014; Saraguro Bravo *et al*., 2016; Staubitz *et al*., 2017). The important aspect in this work is to highlight efforts related to the use of gamification in the context of Foreign language learning.

Figure 4 illustrates a practical framework of using gamification in MOOCs to boost Chinese language learning and Chinese culture practically (Metwally and Wang, 2017). This framework concentrates on various perspectives to implement gamification in MOOCs, including instructional design perspective, gamification and course elements perspective as well as gamification and course interface perspective. Different gamification mechanics implemented in this framework as virtual currency, levels, badges, leaderboards, notifications, progress bars, and activating points systems. The working mechanism of this framework is delineated as follows:

- Different Chinese courses are published on MOOCs platform.
- Learners can create an account on a platform and enroll in Chinese language and culture course according to their Chinese proficiency level.
- Learners must complete a compulsory placement test to classify them in appropriate level (i.e. Beginner, Intermediate or Advanced).
- Every learner can select an avatar as a profile picture.
- Learners get a number of points, appeared on their profile, to motivate them to collect more and attain skills
- Learners also get virtual currency shown on their profile.
- Learning objectives seems like tasks require efforts to study and answer quizzes to perform these tasks.

Remarkably, using gamification mechanics in a massive Chinese course, augmented learner's motivation was noticed and encouraged them to complete the course if deemed appropriately designed. Chinese language learners have interacted more and more in the learning process because it was a personally meaningful and fun experience.

A gamified application: Playful Frame

In Cruaud (2016), a gamified application, created in cooperation with teachers, researchers, and developers, was introduced in a French as a Foreign Language class in a Norwegian upper secondary school.

It was designed to be an extra class resource for the teacher and composed of a web-based application utilized by teams of students. The application designed using the framework of the action-oriented approach, wherein the student utilizes the target language to resolve tasks. Language learning tasks are variant, including writing an article, creating a vocabulary quiz,

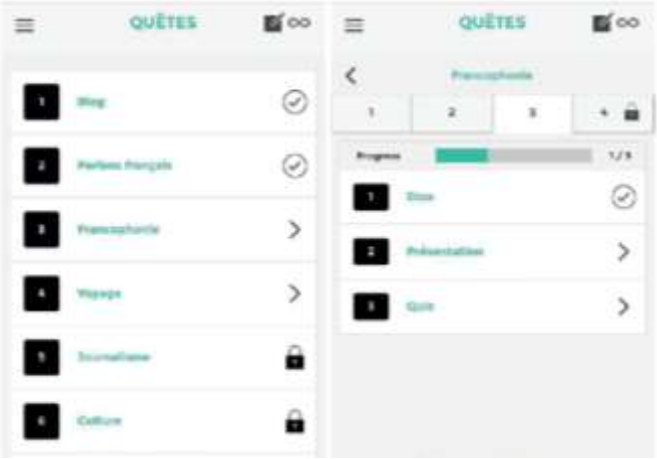

Figure 5. Screenshot from the quest page, 'Quêtes',

filming a video, and interviewing other students. The tasks are categorized into various levels within quests that the students complete collaboratively as teams. A screenshot of the quest page is shown in Figure 5. On the quests page, achieved quests are marked with a check symbol; outstanding quests have an arrow while locked quests are marked with a padlock.

The application enables students to solve tasks, tracking their team's progress, exchange messages, and gain badges. They can gain either automatic badges for completing a specific number of tasks or teacher badges awarding good-quality work and participation. Moreover, the students can write messages to the whole class on a notification board in the application, hence creating a social place to practice the foreign language.

Empirical data gathered from a one-year-long observational study in a French-as-a-foreign language classroom. The findings illustrated that the usage of gamification in Foreign Language Learning makes students more excited about the learning activates. They were in more contact with each other and developed various documents in the foreign language.

Additionally, the gamified structure reinforces the concept of learner autonomy and grants students the chance to build their learning paths. In general, this study illustrates a positive outcome from the gamification perspective. However, it stated that utilizing gamification might be a challenge for several educators. Further research and practice contributions related to the design of a gamified application to examine playful learning status in FLL are required.

Gamified instructional unit: Vida Perú

Vida Perú, a gamified instructional unit that includes game elements developed for elementary Spanish students at the University of Pittsburgh, Greensburg (Orsatti, 2017). It enables the learners to learn Spanish as a Foreign language by integrating the technology into the curriculum. Vida Perú was designed using Quest-Based Learning (QBL) approach and is composed of seventy-one quests. These quests involved culturally authentic tasks and language activities. All quests are tied together through a storyline about leisure activities theme in modern and ancient Peru. Most of the quests have been completed online individually by students using their laptops. Other quests were implemented via regular class meetings where the students gained experience points (XP) for completing quests. Also, they earned badges, awards, and achievements, for additional experience points depending on their participation and engagement level with Vida Perú. The effect of gamified quests on the participants' motivation to learn Spanish and their willingness to communicate in Spanish was empirically investigated. Findings illustrated that participants were comfortable with Vida Perú compared to the traditional classroom setting. However, it did not provide adequate opportunities to communicate willingly in Spanish with others. Moreover, the majority of participants experienced a higher level of engagement with Vida Perú's capabilities of goal setting, structure, narratives, storyline, avatars, gameplay, challenges, badges, rewards, and feedback. Whereas, some participants did not feel engaged with the point system, game rules, setup, and quest design.

Course level gamification

Gamification of teaching English as a Foreign Language (TEFL) in Japan sounds largely unimplemented despite the adoption of English in other areas of education inside and outside of Japan. A study in Baber (2015) considers the position of gamification in TEFL education in Japan offers two examples of course level gamification are Business English course and Negotiation course. Both courses target high intermediate and advanced students.

Business English course provides skills as presentation, summarization, email composition, short writing assignments, and student self-evaluation. The students must complete tasks successfully to move to the next level. Their grades are computed through the number of tasks completed in the higher levels. Examples of the game elements implemented in this course are points, levels, feedback (e.g., Individual feedback for every task), progress path, and rules.

In the negotiation course, the students achieve badges per their competency in negotiation. Examples of the game reward elements implemented in the negotiation course are levels (i.e., bronze, silver and gold), feedback (Individual feedback for every task), progress path, and badges.

Some findings based on the analysis of the two courses indicated that gamification could save educator time, as shown in the Business English course, wherein tasks are prepared and cursorily evaluated (i.e., one time listening or a quick visual review). Also, gamified courses can provide benefits to educators, such as managing student outcomes, time efficiency, students' motivation, engagement, and enjoyment. However, several limitations have been noticed, such as lacking data about students' reactions and attitudes to the gamified formats, lacking data from TEFL tutors on their gamification experiment. Predictably, gamification has the potential to develop TEFL in higher education in Japan, through implementing a variety of gamification elements using different methods and capabilities to reinforce TEFL studies in Japan.

Paper-based gamified curriculum

In contrast to the other described gamified techniques for FLL, Lombardi developed a paper-based gamified curriculum for an English-as-a-foreign-language class at the University of Fukui, Japan (Lombardi, 2015). In addition to FLL, this study was found to be more intriguing as it confirms that gamification does not require digitalization, where the same basics of playfulness can be used in different approaches. This idea was inspired by role-playing games (RPGs). In a gamified fantasy kingdom called Fudukai, the learners are heroes during the training and must perform tasks by actively using the official language of the kingdom, i.e. English. The teacher is a mentor who guides learners through the path. Learners are rewarded with points for completing tasks. Learners can glue or draw their avatars, write their names, and mention their hero names. Also, the points can be achieved for every task if stamped by the teacher.

There are two types of tasks, weekly tasks, and extra tasks. Weekly tasks are linked with course progression, while extra tasks are available for learners to choose from and achieve at any time. Such tasks intend to motivate learner's participation in the class using the target language. At the end of the course, points contribute to the course grades. Students start the year with the lowest grade possible and are required to work hard to improve the grade chart by gathering points.

Lombardi was concerned with investigating the impact of game dynamics on students' motivation and engagement. The findings illustrated that students enjoyed the gamified learning experience, and do not mind participating in a similar class again. Moreover, students were motivated in the class activities more than the previous non-gamified courses and semesters. They enjoyed having the chance to speak the target language and illustrated a positive attitude towards the experience through the course of the whole semester.

Gamification in mobile apps

The recent years noticed the swift growth of gamification language in the adoption of mobile technology for language teaching and learning. Mobile-Assisted Language Learning (MALL) provides open access for any learner regardless of both place and time constraints. In Mobile Learning, devices such as smartphones, laptops, iPods, and tablets are used to support language learning. Abundant apps are developed and used for those who want to learn Foreign Language. Such apps provide rousing opportunities for Foreign language learning (Heil *et al*., 2016). It allows learners to access information ubiquitously along with other mobile learning advantages such as built-in video cameras, voice recording capability, high memory capacity, and geolocation features. These features can handle various Foreign language learning requirements.

Game elements provide an engaging experience for users. This, in turn, makes Gamification useful in mobile apps. The main reason why gamification technique into mobile apps is considered is that it is a great option that combines user acquisition with retention. The well-designed gamified mobile app increases the revenue of app owners. Mobile apps attract people's desires, including competition, achievements, self-expression, as well as rewards. Indeed, gamification renders mobile app sustainable and thereby elevating the customer base. Moreover, gamification in apps is an innovative approach in developing an engaging mobile app (Berns *et al*., 2014).

Gamified language learning apps enjoy millions of downloads and widespread fame. These apps use points systems, power-ups, and other gaming elements for an engaging experience and significantly enable the memorization of foreign languages' vocabulary and syntactic grammatical rules. Relatively, integrating game mechanics into Foreign language learning is a traditional academic approach. However, the application of gamification through apps for smartphone and tablet PCs has had thriving effects. In the context of FLL, there are

Figure 6. Screenshots of the Duolingo pages.

numerous gamified mobile apps as in Gangaiamaran and Pasupathi (2017). Duolingo is explained below as a case study of mobile apps developed to improve FLL.

Duolingo is a gamified free language-learning platform designed to assist users in learning languages. As of April 2016, Duolingo is available in 59 languages and offers courses for 23 languages. The temple of a language course in Duolingo is a modular container of 'lessons.' A lesson is well-organized that tests the skills of learners with various challenges. Such challenges are comfortable and fun to indulge and are classified into skill sets related to speech or vocabulary meanings. Each skill has a strength progress bar, which gets filled only when a learner has completed all lessons in the skill. Initially, only the fundamental skill is available, and other skills are locked. To unlock other skills, learners have to pass all their available skills.

Figure 6 shows screenshots of the Duolingo pages. The authors have applied substantial gamification to motivate and engage their users through gaming elements such as reward, leaderboard, levels, badges. 'lingot' is a reward; users can gather lingots by achieving completing a lesson or mastering a skill. Leaderboard displays how learners fare against their contemporaries. This, in turn, provides excellent motivation for a learner to return to learning frequently to maintain and improve the score on the leaderboard. The level system provides a method to track learners' activity and compete with their friends. Badges in Duolingo also contain accomplishments tokens that represent skills a user has mastered (Huynh *et al*., 2016).

In Rachels and Rockinson-Szapkiw (2017), Duolingo was used to assess the effect of gamification on third and fourth-grade students' Spanish language performance and student academic self-efficacy. In this study, findings show that students taught using gamification via Duolingo on a device, learn as much as other students taught in a traditional, face-to-face learning environment. The results also indicated that students taught using gamification via Duolingo do not vary in overall academic self-efficacy in comparison to the students taught in a traditional environment. This illustrates that Duolingo a useful tool for teaching the Spanish language to elementary students.

In contrast, three mobile apps for FLL were examined to explore the essential elements of gamification that can be employed for teaching language (Rego, 2015). The results confirmed that learning foreign languages can be improved significantly through mobile learning with gamification elements. Elements like context and collaboration are critical to learning a foreign language. Also, the study shows that the challenge in using gamification elements in mobile language learning is specific elements such as the translation of sentences devoid of a context. A summary of the gamified techniques described above is provided in Table 1.

RELATED WORKS

Nowadays, the world has become increasingly interdependent and interconnected. Foreign language proficiency is considered a trump card that provides individuals the opportunity to engage with the different societies around the world. It enables people to create a deep and meaningful connection in private and professional life. Researchers attempt to innovate methods encouraging people to learn foreign languages. Several comparative studies between methodologies exist to learn foreign languages have conducted. Examples of such studies are highlighted briefly in this section.

Anil (2017) reviewed a set of innovative methods that are applicable in the classroom of second language learning. Such methods included movies, media, newspapers, creating sandblot, and advertisements

Table 1. Summary of Gamified Techniques of FLL.

Technique	Description
Augmented reality (AR): GaMbAR	A gamified mobile learning system utilizes AR (i.e. marker-based AR) to support Foreign language learning activity
Mobile, place-based language learning tool: Explorez	Explorez is a first place-based gamified learning tool directed towards procuration of French language skills. It is a virtual fictional treasure hunt in which the player is pretended as the personal assistant to a famous French personality
Expert Point Cloud ($EP) recognizer algorithm	An algorithm used as the calibration of writing Japanese letters via comparing the learner input with the datasets. It aims to improve Japanese letters writing process
Gamification framework	A practical framework using gamification in MOOCs to boost Chinese language learning and Chinese culture practically. It concentrates on various perspectives to implement gamification in MOOCs including instructional design perspective, gamification and course elements perspective as well as gamification and course interface perspective
Gamified application: Playful Frame	A gamified application to learn French as a Foreign Language. It was designed to be an extra class resource for the teacher. It is composed of a web-based application utilized by teams of students. The application enables students to solve tasks using the target language, tracking their team's progress, exchange messages and gain badges
Gamified instructional unit: Vida Perú	A gamified instructional unit aims to learn Spanish as a Foreign language through integrating the technology into the curriculum. It was designed based on quest-based learning method. All quests are tied together through a storyline about leisure activities theme in modern and ancient Peru
Course level gamification	It integrates game elements into two English courses in order to gamify teaching English in Japan
Paper-based gamified curriculum	Paper-based gamified curriculum for an English-as-a-foreign-language class at the University of Fukui, Japan. Students act as a hero in training in a fantasy kingdom called Fudukai. In this kingdom, students must perform tasks by actively using the target language and the teacher became mentor guiding students on their learning path
Gamification in mobile apps	Mobile apps integrated game elements to provide a playful experience for learners

interpretation which can be used to develop second language learners' capabilities. Besides, he emphasized the need to understand the students' learning abilities and alter teaching methodologies accordingly. This, in turn, will facilitate the way to learn the second language, such as English meaningfully, and encourage learners to understand the importance of second language acquisition.

Rashed *et al*. conducted a comparative study of teaching methods applied in English as a Second Language (ESL) classroom in Bangla version schools and English version secondary levels in Bangladesh (Rashed *et al*., 2017). For this study, a random sample of teachers and students was chosen from both the ESL classroom of Bangla and English version schools at the secondary level. The study results illustrated that both Bangla and English version schools tutor their student's deductive grammar lessons. Bangla medium school

teachers prefer the communicative method for grammar-based pedagogy, while English medium teachers use communicative approaches in a comprehensive way.

Celik and Kozikoğlu (2016) conducted a comparative study of the Language Learning Strategies (LLS) commonly used by the monolingual and bilingual language university student. More than 500 university students from Bülent Ecevit University Çaycuma Vocational School and Yüzüncü Yıl University participated in the study. “Strategy Inventory of Language Learning” found by Oxford in1990 and adapted into Turkish by Cesur and Fer in 2007 was selected to collect data of the study. Oxford divided language learning strategies into two groups which are direct and indirect strategies. Direct Learning Strategies include subcategories are cognitive strategies, memory strategies, and compensation strategies. Indirect Learning Strategies include Meta-cognitive plans, affective strategies, and social strategies.

The findings of the study illustrated that university students use language-learning strategies moderately. In general, bilingual students tend to use language-learning strategies for more than monolingual students. Moreover, Meta-cognitive was the most repeated strategies used by both bilingual and monolingual students. However, bilingual students make use of them frequently compared with monolingual students. Metacognitive strategies indicate high-level management skills, including planning, organization, monitoring, and assessment.

Moreover, the study investigated whether variables, including gender, school type, and the department has an impact on the students’ level of utilizing language learning strategies. Results found that female students use language-learning strategies more frequently compared with male students except for cognitive and affective strategies.

Thamarana conducted a comparative study of different approaches, methods, and techniques used to learn the English language (Thamarana, 2015). It mentioned varying definitions of the terminology related to English language learning like approaches, methods, and techniques. Also, it discusses the strategies (audiolingual approach, situational approach, cognitive code approach, total physical response approach, and communicative approach) methods such as direct method, audio-lingual method, and techniques (drills, dialogue, role-plays, and sentence completion). He concluded that every approach, practice, or procedure owns a set of features and defects that should be employed in a real class environment to master four language skills.

As the world moves forward, the Learning environment, including Second language learning, has changed to be more technology-oriented. Gamification is a new concept adaptable to the digital world. It plays a definitive role in motivating Second Language learners via incorporating various game elements in the learning environment.

This research work attempts to present techniques that have been integrated gamification concepts to improve FLL approaches. It conducts a comparative study among these techniques and demonstrates their competence in the context of learning outcomes. This work might serve as a basis for researchers concerning improving FLL via gamification. It facilitates the selection process of a gamified technique resonating with the students’ needs and preferences. Besides, it scales the horizon of opportunities in finding a new method to simplify the FLL.

COMPARTATIVE STUDY

This section provides a comparative study of the gamified FLL techniques described earlier. It compares such techniques concerning five parameters are game mechanics, design model, Augmented Reality, student tracking mechanism, and interaction means. These parameters were chosen in an attempt to clarify relative strong points in each technique and find common characteristics among them. "Game Mechanics are constructs of rules and feedback loops intended to produce enjoyable gameplay. They are the building blocks that can be applied and combined to gamify any non-game context" (Kumar, 2013). The design model indicates a set of activities that a designer may follow within the system design process. Augmented Reality defines whether the gamified technique depends on the augmented reality. Augmented Reality, as described earlier, is a technology that blends the representation of real elements with virtual elements, including text, sound, image, 3D objects, or animation. It merges real and virtual objects in a real environment. A student tracking mechanism is a facility to track students' progress in their learning environment. It enables teachers to direct lessons and learning processes at all to improve student's achievements and their mastery levels. The interaction mechanism enables learners to provoke action in the e-learning environment. It plays an essential role in enhancing the cognitive aspects of learners and engagement levels among them.

GaMbAR system (Salman, 2017) uses game elements like levels, points, and badges. It follows the Design Research Methodology (DRM) founded by Blessing and Chakrabarti (2009). This methodology composed of four necessary steps; Research Clarification (RC), Descriptive Study I (DS-I), Prescriptive Study (PS), and Descriptive Study II (DS-II). In the RC step, evidence that can support research assumptions is collected from the literature. DS-I step is classified into two types are review-based DS-I and comprehensive-based DS-I. Review-based DS-I involves an exhaustive review of the literature in the research area and potentially related areas defined in the previous step. The Comprehensive DS-I includes empirical studies in addition to the literature review. Points, badges, and levels of game mechanics are implemented into vocabulary material components.

Other components of language learning, such as listening, grammar, and conversation, did not integrate game elements. GaMbAR uses a review-based DS-I. PS step involves a systematic development in solving the research problem. Huang and Soman Steps in making learning games have been used as a reference in the implementation of GaMbAR (Huang and Soman, 2013). The last step of DRM is DS-II which aims to identify whether the efforts made in the previous steps contribute to the success of the proposed system. Mainly, it depends on augmented reality as well as gamification. MySQL is used to keep student learning progress. The work does not explain the interaction aspect among learners using GaMbAR

Explorez tool integrated different game mechanics such as points, badges, quests, and challenges (Perry, 2015). It is developed using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) design model (Hess and Greer, 2016). Mainly, it depends on the augmented reality technology and uses GPS technology to transform the target place into a virtual francophone world. No student tracking mechanism mentioned in work. Explorez reinforces the interaction among learners by providing quests. These quests involve individual challenges as well as group challenges learners can select.

$EP algorithm integrated with the RPG game involves a set of game mechanics like turn-based battle, achievement, badges, points, levels, and status (Udjaja, 2018). No design model followed to develop the algorithm. It does not use AR. No student tracking mechanism mentioned in work. The $EP algorithm does not support the interaction aspect between learners, but the RPG game in which the $EP algorithm is applied reinforces the participation between players through turn-based and ATB.

Points, progress bars, badges, leaderboards, and virtual currency are game mechanics incorporated in the gamification framework developed in Metwally and Wang (2017). ADDIE (Analysis, Design, Development, Implementation, and Evaluation) design model was chosen to develop the framework. In the analysis phase, the learning environment and Chinese language learners' expectations are analyzed to manage the gamification technique effectively. The design phase reconstructs the Chinese language course in the MOOC environment to match gamification techniques. The development phase builds the Chinese course platform and applying different game mechanics. The implementation phase involves necessary tests of the developed platform to observe learner's behavior while using the Chinese course platform integrating gamification. Using gamification in a massive Chinese language course is assessed in the evaluation phase. The framework does not use AR. The student tracking mechanism used is a progress report. The framework supports communication among learners via social networks and discussion forums, which allow learners to build social interactions for Chinese language learners.

The gamified application developed in Cruaud (2016) integrates badges (i.e., group badges and personal badges), levels, progress bars, unlocking systems, teams, and quests game elements. Design-Based Research (DBR) methodology was selected to develop the application. DBR is a systematic but flexible methodology. It aims to enhance educational practices by implementing iterative analysis, design, development, and implementation. It depends on the collaboration between researchers and practitioners in real-world settings. Besides, it leads to contextually-sensitive design theories and principles without using AR. Counting the number of tasks achieved by a student can serve as a student tracking mechanism. Playful Frame support interaction feature since offers a collection of quests students can perform collaboratively. Moreover, the message board and check-in exists in the application supports the interaction feature as well.

Quests, narratives, goals, structure, storyline challenge and competition, avatars, rewards, badges, and feedback are examples of game mechanics used in Vida Perú (Orsatti, 2017). It uses the Design-Based Research methodology, systematic method of development, and improvement of instructional styles in natural classroom settings via cycles of development, implementation, evaluation, and revision. Vida Perú does not use AR. Relatively, the Feedback mechanism can keep student tracking through levels, which shows how far the learner was progressing towards the next step. Vida Perú supports two forms of interactions are social interaction and cultural interaction. In social interaction, players engaged in social activity via Vida Perú with classroom tasks such as vocabulary games in teams. In cultural interaction, Vida Perú has immediate and local relevance for learners. For instance, players may be able to make materials for Pitt-Greensburg students doing a study abroad in Peru.

Game mechanics, including points, levels, themes, feedback, progress path, and challenge are integrated Into Baber (2015), there is no design model used in this approach. It does not use AR. The educator tracks students' progress using a spreadsheet mechanism. Business English course delivers teaching to students in small groups in the form of coaching, micro-conferences, and peer evaluation. This point may support the interaction between learners.

Missions (i.e., weekly mission and extra mission), progress bar, goal, feedback, points, and journey are examples of game elements integrated with the approach introduced in Lombardi (2015); there is no design model or AR used in this approach. Arguably, the approach introduced in Lombardi (2015) is students themselves tracking their progress via a point-based system that converts to a grading scale (i.e., the more missions students achieve, the higher grade they earn). The

Table 2. Summary of comparative study.

	Game mechanics	Design model	Augmented reality	Student tracking mechanism	Interaction
GaMbAR	✓	✓	✓	✓	X
Explorez	✓	✓	✓	X	✓
Expert Point Cloud ($EP) recognizer algorithm	✓	X	X	X	X
Gamification framework	✓	✓	X	✓	✓
Playful frame	✓	✓	X	✓	✓
Vida Perú	✓	✓	X	✓	✓
Course level gamification	✓	X	X	✓	✓
Paper-based gamified curriculum	✓	X	X	✓	✓
Mobile apps	✓	X	X	✓	✓

paper-based gamified curriculum encourages interaction between learners since it allows for tackling tasks in small groups.

The last gamified technique in the FLL area is mobile apps. Numerous gamified mobile apps for FLL are available in the App stores. Such apps provide different skills and services to encourage language learning in different age groups. Analyzing the characteristics of each app individually is difficult, and may be applied in the future. For comparative study purposes in this work, only the Duolingo app is considered.

Duolingo integrates game elements such as reward, leaderboard, Levels, progress bar, badges. There is no design model or AR used in Duolingo. The progress bar for each skill is available to track student performance. The comment thread in most of the questions allows learners to discuss it in detail. The app also has community features that allow learners to communicate with other people who are learning the same language (Huynh *et al*., 2016). A summary of the comparison between existing gamified FLL techniques is shown in Table 2.

DISCUSSION

The purpose of using gamification in the FLL is to motivate learners and increase engagement among them via implementing game mechanics into a non-game context. Section 2 reviews various gamified techniques used to reinforce FLL. As shown in Table 2, all highlighted techniques integrated different game mechanics, for example, points, badges, leaderboard, level, quests, progress bar, and challenges. Such game mechanics had a significant contribution in motivating learners in learning a foreign language, stimulating the interaction of learners and system, as well as interaction among learners themselves. This section highlights the impact of using gamified techniques on the learning outcome or student progress in learning.

In Salman (2017), findings of using the GaMbAR system in a case study related to learning French vocabularies as a foreign language in Indonesia illustrate that utilizing AR in gamification can improve student's motivation and increases the sense of achievement in learning the outcome.

The Explorez tool provides an example of how to use AR in learning the French language as a Foreign language. The participants in the experiment of Explorez were asked to fill a questionnaire regarding their experience with the tool. Descriptors in the questionnaire were: "fun", "motivating", "useful" and "relevant". 88% of participants described the experience as "fun," 54.5% answered as "motivating," while 63.6% responded as "useful." Accordingly, participants seem enjoyed by using Explorez's tool in learning the French language. This indicated that Explorez plays a sizeable role in improving learning outcomes.

However, the usability of AR is a challenge in some situations such as awkward technology experience, interface design mistakes, and the lack of teacher's experience with technology. There are critical pedagogical issues that need to be overcome. For instance, the need to more class time, the low sensitivity trigger to recognition, GPS errors as well as the need to some prerequisites for using AR technology such as hardware (e.g., mobile devices, and tablets) and an Internet connection. When these requirements of AR usage are met, these challenges are addressed. On the other hand, Mobile and location-based language learning tool like Explorez provides an opportunity for remote learning. This encourages learners to engage in unfamiliar yet innovative learning methods.

The $EP recognizer algorithm introduced a mechanism to improve the Japanese writing process (Udjaja, 2018). This method has been utilized to spur the sensory and

motor nervous system as well as motivate students (players) to study harder. $EP is implemented in the RPG game battle system. It attracted players to learn how to write Japanese letters. It improved the learning outcomes since it boosted players' ability from 20% to 100%. Although $EP had a positive impact on the player's ability to learn Japanese letters, it has several limitations; it relies heavily on mathematical equations, This means that any mistake in calculating the midpoints or distance between points (i.e., resample stage) affects negatively on the accuracy ratio of learner's writing. Also, the dataset used in the $EP algorithm is limited to Japanese letters. It is recommended to expand such a dataset to involve combinations of common words and phrases. Implementing the $EP algorithm in learning other languages is a positive point to assure the worthiness of such an algorithm in the field of FLL.

In Metwally and Wang (2017), the gamified framework was proposed based on discussions and investigations with Chinese language teachers at Northeast Normal University about implementing game mechanics in Chinese Language massive courses. Besides, it relied on previous background related to applying gamification into the e-learning environment, including MOOCs. The effectiveness of this framework on the learning outcome has not investigated yet, but it is mentioned in this research since it seems to be a promising attempt for connecting gamification into language learning the massive courses. To expose the effectiveness of the framework on the learning outcome and student motivation practically, developing a MOOC platform incorporates game mechanics in the Chinese language massive course is recommended in the future.

The gamified application in Cruaud (2016) was designed using the framework of the action-oriented approach. In this approach, students are social agents utilizing the target language to interact and carry out specific actions, to gain a high degree of autonomy. Besides, elements of the target language such as vocabulary, syntax, cohesive forms, and phonology are used automatically to simplify communication among learners. These features play an essential role in supporting FLL. Overall, using this gamified framework in FLL makes students more excited about learning activates. They were in more contact with each other and developed various documents in the foreign language.

Vida Perú (Orsatti, 2017), an instructional unit to learn Spanish as a foreign language supported, proved that most of the students prefer to learn through technology instead of the traditional classroom setting. In spite of that, Vida Perú did not provide adequate opportunities for participants to communicate willingly in Spanish with others. Findings indicated that participants were more comfortable in learning via Vida Perú compared to the traditional classroom setting; quests-based learning methodology might increase student motivation. A revised version of Vida Perú is recommended to provide appropriate communication in Spanish among learners to provide suitable opportunities for interaction in the FLL.

In the course level gamification technique (Baber, 2015), game mechanics are integrated into the Business English course and Negotiation course. The benefits of using game mechanics into two courses were analyzed in terms of five goals, including learner outcome, student motivation, student engagement, student enjoyment, and teacher time efficiency. Results demonstrated that game mechanics enhanced the learner outcome, have a neutral impact on student motivation, engagement as well as enjoyment. Also, it saves the teacher time in the Business English course since tasks were designed in a way that can be evaluated merely, such as a quick visual review or one-time listening, which in turn saves the educator time. However, the Negotiation course depends on practice and skills and demands repetition. Besides, evaluation in the negotiation course was based on observation, which consumes educator time.

Paper-based gamification introduced a different idea since it confirms that gamification does not require digitalization, where the same basics of playfulness can be used in different approaches (Lombardi, 2015). Lombardi presented a game-informed English class that incorporated various game mechanics such as points, avatars, and missions. The goal was to improve student commitment and engagement in English classes. They were able to perform this goal since this technique grants students a feeling of relatedness, competence as well as autonomy. Accordingly, this gamified technique can be an excellent and effective method to make homework more enjoyable. It gives students a tangible aim to do a mission (i.e., homework), the option of time, place, and style to perform it. This, in turn, transforms the whole English class into a game-like class.

Findings of using Duolingo in teaching Spanish language to third and fourth-grade students' do not vary in overall academic self-efficacy in comparison to the students taught in a traditional environment (Rachels and Rockinson-Szapkiw, 2017). This proved that the gamified mobile app Duolingo is a useful tool for teaching the Spanish language to elementary students. Although the gamification approach in FLL mobile apps provides a great opportunity to accelerate learners' benefits, increase motivation, and engagement chances for them, some pitfalls can produce the opposite result. Some guidelines should be considered when developing IOS or Android apps using gamification (Alsawaier, 2018). For example, do not make gamification mandatory, the gamified application can be an incorrect option if the app has a vast audience because not all users favor gamified apps. In this case, the gamification feature is elective. Another suggestion is to perform an accurate survey to find the most motivated game elements for the app fan base before incorporating gamification actually in the app. Another aspect of consideration is the clarity of goals. Learners need to understand how to use the

gamified app through an overall illustration of the app idea, goals, and steps to achieve such goals. If the plan is not clear from the beginning, learners may lose their desire to learn and proceed. Also, do not grant rewards for just anything; rewards should be challenging to obtain. If it is too easy to get, no one values it, and vice versa, too difficult aims induce learners that it does not even deserve trying.

To conclude, the usage of game elements in the FLL environment offers several benefits; it increases learner engagement, motivates them to use the target language, and reduces their anxiety to expressing oneself in the target language. However, these benefits may not suffice if the learners are solely following the teacher's directives in the style of a monologue, and also if the learners are not active participants in the gamified learning atmosphere or if they have no control throughout the game. Learners should be players and hence gain a reasonable autonomy over their learning and their playing.

In addition, it is not possible to decide which gamified technique is the best since each one presents several features valid for a particular learner and inappropriate for another depending on his background, abilities, and requirements.

CONCLUSION

This paper provides a review of several techniques that integrated the gamification concept to improve Foreign Language Learning. Nine gamified techniques found in the literature have been covered are as Augmented Reality (AR), mobile and place-based language learning tool (i.e., Explorez), Expert Point Cloud ($EP) recognizer algorithm, gamification framework, gamified application (i.e. playful frame), gamified instructional unit (i.e. Vida Perú), course level gamification, paper-based gamified curriculum as well as gamification in mobile apps dedicated to FLL. Each technique has been reviewed and discussed. A comparative study among these gamified techniques has conducted based on five parameters are game mechanics, design model, augmented reality, student tracking mechanism, and interaction methods. Resultantly, gamification plays a definitive role in motivating Second Language learners. It is not possible to decide which gamified technique is the best since each one presents several features valid for a particular learner and inappropriate for another depending on his background, abilities, and requirements. This work might serve as a basis for researchers concerning improving FLL via gamification. Although some constraints of such techniques, it decreases the bewilderment and dexterity in the presence of numerous gamified techniques in the context of FLL. In the future, further gamified techniques to be proposed and examined to enhance the FLL as the use of Gamification in FLL contributes positively to motivate learning experience based on the information presented. Moreover, a detailed investigation of the gamified mobile apps that handle the FLL matter will be performed.

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