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SERIOUS GAME EDUCATIONAL AS A MEANS OF ACQUIRING GERMAN LANGUAGE SKILLS IN A NON-FORMAL EDUCATION SETTING[i]

Ayman Guemri[1,2ii],
Inés Souid[3],
Mohamed Kharrat[4]
[1]Faculty of Economics and Management of Sfax,
University of Sfax,
Tunisia
[2]Group for the Study of Development
and Social Environment (GEDES),
University of Sfax,
Tunisia
[3]Research Laboratory on Vulnerabilities
and Innovations in Sport(LVIS) ,
University of Lyon,
France
[4]Faculty of Letters,
Arts and Humanities of Manouba,
University of Manouba,
Tunisia

Abstract:
This study aimed to assess the effect of Serious Game Educational on the acquisition of written language skills in German in a non-formal setting. A total of 23 students from different state universities, aged between 19 and 23, participated in an Educational Serious Game session through a game called "Deutsche Straße" knowing that all students had no experience in the German language. The students were divided into groups of 4 players for each game session, which lasted between 30 minutes and an hour. A German Word Play Learning Assessment Questionnaire was administered prior to the intervention (t0) and immediately after each session (t1). This questionnaire is in the form of a multiple-choice question with 107 items which is called "Deutsh Straße Quiz". These items represent the translation of different German words from the game provided by an expert in German language translation. A second satisfaction questionnaire that measures the feeling of competence (Dumont *et al.*, 2000). The results showed an average relative learning gain of more than 40% for the majority of students. In addition, there is

[i] SERIOUS GAME EDUCATIONAL ALS MITTELDES ERWERBS VON DEUTSCHKENNTNISSEN IN EINEM NICHT-FORMALEN BILDUNGSUMFELD

[ii] Correspondence: email ayman.guemri@yahoo.fr

a sufficient sense of competence following the game. These results suggest that the use of Serious Game Educational in academia in a formal educational setting can be an effective way for students to read and comprehend the German language.

Keywords: educational serious game, language skills, non-formal education, German language

Abstrakt:
Ziel dieser Studie war es, die Wirkung von Serious Game Educational auf den Erwerb von Schriftsprachkenntnissen in Deutsch in einem non-formalen Setting zu bewerten. Insgesamt 23 Schüler verschiedener staatlicher Universitäten im Alter zwischen 19 und 23 Jahren nahmen an einer Educational Serious Game-Sitzung über ein Spiel namens "Deutsche Straße" teil, in dem Wissen, dass alle Schüler keine Erfahrung mit der deutschen Sprache hatten. Die Schüler wurden für jede Spielsitzung, die zwischen 30 Minuten und einer Stunde dauerte, in Gruppen von 4 Spielern eingeteilt. Vor der Intervention (t0) und unmittelbar nach jeder Sitzung (t1) wurde ein Fragebogen zur Bewertung des Lernens von deutschen Wortspielen durchgeführt. Dieser Fragebogen hat die Form einer Multiple-Choice-Frage mit 107 Items, die als "Deutsh Straße Quiz" bezeichnet wird. Diese Gegenstände stellen die Übersetzung verschiedener deutscher Wörter aus dem Spiel dar, die von einem Experten für deutsche Übersetzungen bereitgestellt wurden. Ein zweiter Zufriedenheitsfragebogen, der das Gefühl von Kompetenz misst (Dumont et al., 2000). Die Ergebnisse zeigten einen durchschnittlichen relativen Lerngewinn von mehr als 40% für die Mehrheit der Schüler. Darüber hinaus gibt es ein ausreichendes Kompetenzgefühl nach dem Spiel. Diese Ergebnisse deuten darauf hin, dass der Einsatz von Serious Game Educational in der Wissenschaft in einem formalen Bildungsumfeld eine effektive Möglichkeit für Schüler sein kann, die deutsche Sprache zu lesen und zu verstehen.

Schlüsselwörter: pädagogisches Serious Game, Sprachkenntnisse, non-formale Bildung, deutsche Sprache

1. Introduction

Acquiring a foreign language is becoming necessary nowadays, especially with globalization, where the world is becoming a small village. Language skills are the set of abilities to express oneself in one's own mother tongue or in a foreign language. Reading, writing, listening and speaking are the indicators that make it possible to assess a learner's mastery of a foreign language. Indeed, acquiring the German language is a dream that concerns all students in all specialities, given their importance in scientific research and especially in terms of opening up prospects in terms of the job market, such as technicians, engineers, nurses, doctors, etc.

According to the German Federal Foreign Office (2020), German is the most widely spoken language in Europe (100 million native speakers); in addition, German is the second most important language in the field of science. Indeed, learning the German language is very difficult. It is the 7th most difficult language in the world. Despite the difficulty of the German language, there are many doors in the logic, and behind every difficulty lies opportunity (Albert Einstein).

Several solutions are available for learning language competence. Play-based learning is a concept used in education to describe how a child learns by making sense of the world around them through play activities. Jack Kahn and Susan Elinor Wright (1980) actively recommend ways of using serious games in learning in several domains in formal and non-formal education to ensure more motivation and acquire several skills. Indeed, the Educational Serious Game is a competitive activity aimed at achieving pedagogical goals to encourage knowledge acquisition.

Clark and Mayer (2008) distinguish between two types of Educational Serious Games: games dedicated to learning or the development of cognitive skills and simulations allowing the implementation of training from a virtual environment. For these authors, Pour Alvarez and Djaouti (2008), the Serious Game conveys messages. Indeed, there are several approaches to classify serious games, such as the taxonomy of Alvarez and Djaouti (2008), which is directly inspired by the work of Sawyer and Smith (2008).

According to Bugmanss *et al.* (2015). The Serious Game encourages interaction between these students. A serious game is an activity that presents an artificial situation in which one or more players, placed in a position of confrontation with other players or in cooperation against other forces, are governed by rules that structure their actions with a view to a well-defined goal, namely to win (winner vs. loser) (Sauvé *et al.* 2007). This study is part of the field of literacy, mastery/non-mastery of writing: this conception of literacy considers the learning of writing over time, which is still developing) (Boch, Grossmann & Rinck, 2015).

The objective of our research is to evaluate the effect of Serious Game Educational on the acquisition of written language skills in German in a non-formal setting.

2. Materials and methods

2.1 Participants

A total of 23 male students from three different Tunisian public universities (Table 1) aged 19 to 23 were recruited to participate in the study.

Table 1: Academic affiliations of participants

Institution	Speciality	Number	Total	Total
Faculty of Economics and Management of Sfax	Finance	4	21	23
	Business Informatics	9		
	Accounting	4		
	Economy	1		
	Logistics	1		
	Management	1		
Higher Institute of Computer Science and Multimedia of Sfax	Computer Science	1	1	
Higher Institute of Arts and Crafts of Sfax	Interior Architecture	1	1	

The students were divided into groups of 4 players for each game session, which lasted between 15 and 30 minutes for each group. This Educational Serious Game is provided by a commission composed of: 1 referee, a referee committee chairman, quiz or questionnaire corrector and a general coordinator. The total population participating in the experiment consists of 23 students (see Table 2). This Serious Game is called "Deutsche straße" and is intended for people who have no experience in the German language; for this reason, we have eliminated students who have studied the German language as an optional subject during the academic course (secondary education). The total number of the statistically analyzed population becomes 17 (elimination of 6 students). Participants included 13 boys and 10 girls (Table 2).

Table 2: Characteristics of the participants

Participants(n)		23
Age (years)		20,96
Gender	**M**	13
	F	10

2. Procedure

Regarding the game, it is formed by a street that represents the different embassies and organizations, the different traffic laws and a geographical map encompasses the different German federal.

Figure 1: Game content "deutsche straße": example street

During the game, each player can draw red and yellow colored cards (Figure 1). In the first half of the street, each participant can draw a red card called "information and question" This card contains two parts: one part represents information about German culture, and one part is related to the map. During the second half of the street, each participant can draw a yellow card called "picture and word". This card contains two parts: one part represents an image of German culture and a German word that each participant tries to get to know. During it, each participant can earn and lose points; from these points, he can buy a federal state card. The participant who collects the maximum number of federal states is considered a winner. The game ends when a participant collects the maximum number of states.

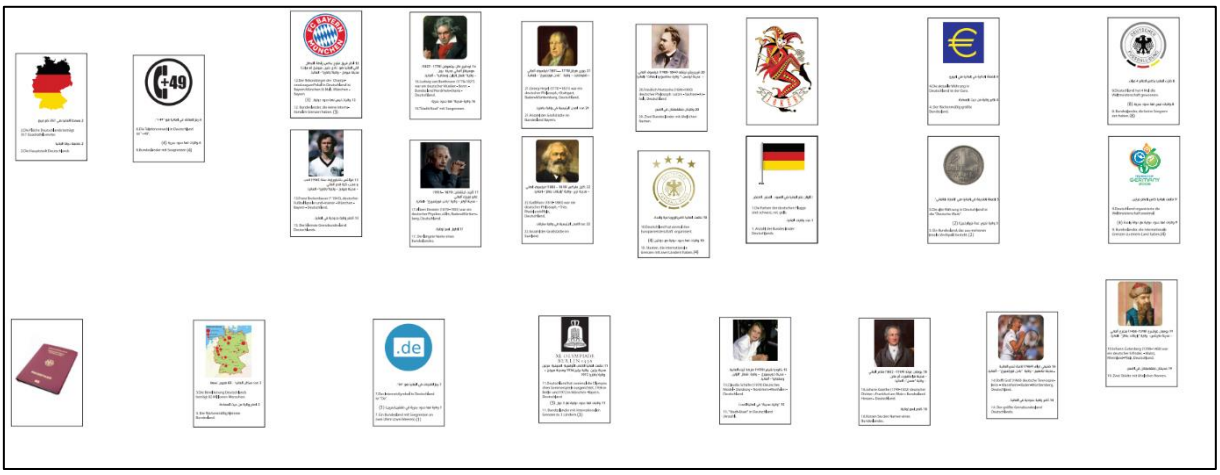

Figure 2: Contents of the red and yellow card

A pre-test was conducted after the questionnaire was set up and before the sample survey was launched. Our first concern in the pre-test was to ensure that the interviewees understood the questions as well as possible. Therefore, we applied this test to a small sample belonging to the survey universe, but it does not belong to the extracted sample and has the same characteristics as the study population. In this questionnaire, we took into consideration the different remarks, and then we changed some of the expressions of some questions to correspond to the meaning of our research. Based on the game, we built a quiz questionnaire that included different German words for the different components of the game. To assess the mastery of the German words entered in the game, the respondent takes the self-assessment, which consists of choosing between 3 answers, a, b and c, on a multiple-choice question that represents the words entered in the game. These factors represent the 3 components of the game, and each has sub-factors, according to the table below (Table 3). The questionnaire items are arranged in the questionnaire in the following order:

Table 3: Order of Items in the Scale

N°	Factors	Sub-factors	Numbers	Items
Game Content	Street Content	Embassies & Organizations	12	3, 8, 12, 27, 50, 59, 62, 68, 73, 76, 81, 83, 87
		Signs & Traffic Lights	16	6, 7, 9, 15, 29, 32, 34, 44, 67, 69, 77, 85, 94, 97, 99, 102
	Game Card Contents	Title of the cards	5	10, 18, 63, 71, 82
		Colors	3	5, 17, 64
		Professions	9	14, 20, 31, 41, 51, 65, 89, 100, 107
		Mathematical Words	8	2, 16, 19, 33, 35, 37, 57, 70
		Geography	22	4, 21, 25, 36,39, 40, 43, 47, 48, 53, 54, 55, 72, 74, 75, 84, 88, 90, 95, 98, 104, 105, 106
		Sport	7	22, 28, 45, 60, 86, 96, 103
	Contents of the Maps	Numbers	16	1, 11, 13, 23, 26, 38, 42, 46, 49, 56, 59, 61, 66, 78, 92, 101
		The Federal States of Germany	7	24, 30, 58, 79, 80, 91, 93

The questionnaires will be distributed in January 2024 to the various universities of the University of Sfax. The questionnaires were distributed to the students during class time. The answers are in the form of a multiple-choice questionnaire (MCQ) followed by 3 proposed answers, which are trichotomous items.

A sense of competence influences achievement and well-being in many ways. The Self-Efficacy Measure Scale is a 10-item psychometric scale designed to assess positive beliefs to cope with various difficult demands in life. French adaptation of the General Self-Efficacy Scale is carried out by Dumont *et al.* (2000). This questionnaire has been validated in the academic world by Saleh (2016). The 10 items are accompanied by a Likert-type scale (Attitude Scale comprising 1 to 4 degrees). The individual was asked to express his or her degree of agreement or disagreement with a statement. These items are used to affirm the degree of the feeling of competence according to the answer choice: 1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Totally true. Before starting the experience, all participants were introduced to the objective of the game, game rules and different perspectives.

3. Statistical analysis

Statistical analysis is carried out on a microcomputer using Excel software for response processing. All statistics are considered significant for a probability threshold of less than $\alpha = 0.05$. Homogeneity, or coefficient of variation, is an index that measures the dispersion of data around the mean relatively. It is calculated as a ratio and is expressed as a percentage. This rate is a ratio of two scores: the standard deviation and the mean. According to Hainaut (1975), when the percentage of homogeneity is: below 15%, homogeneity is important. Whereas when the percentage of homogeneity is above 30%, the homogeneity is low.

According to Ouellet (1985), "*the advantage of this index is that it gives an idea of the degree of agreement between the respondents*." According to Gérard (2003), the learning effect can be calculated by calculating the "average relative gain" index. The treatment of this index for each objective makes it possible to have a fairly accurate estimate of the pedagogical effectiveness of the training. According to Gérard (2003), the average relative gain is calculated by the following formula: (AFTER Score - BEFORE Score) / (MAXIMUM Score - BEFORE Score) × 100. A positive learning effect can be considered when this relative gain is greater than 40%.

4. Results

Table 4: Effect of "Deutsche Straße Game Content: Street Content" on students' "written" language skills

Factors	Sub-factors	Date	Statistical analysis					
			Average	Standard Deviation	Covariance	Standard Error	Average Gross Gain	Average Relative Gain
Street Content		Before	0,64	0,22	0,34	0,05	0,15	42,22
		After	0,79	0,13	0,16	0,03		

From the results mentioned above, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game h2 = 0.16% compared to the baseline levels h1 = 0.34%, but this rate remains above 15%. This explains why the game did not reduce the gap that existed before the game, which explains why the learning did not have an "equity" effect. In other words, the differences in the levels of the skills of the students participating in the research are not reduced subsequently, the game has not participated in a greater "sharing" of skills. According to the results, we can still see that there is a positive learning effect (average relative gain) on the feeling of self-efficacy with a relative gain GRM= 42.22% (greater than 40%). This indicates that student participants in the game feel that they have actually progressed during the game with regard to "Deutsche Straße Game Content: Street Content".

Table 5: Effect of "Deutsche Straße Game Content: Game Card Content" on students' "written" language skills

Factors	Sub-factors	Date	Statistical analysis					
			Average	Standard Deviation	Covariance	Standard Error	Average Gross Gain	Average Relative Gain
Game Card Content		Before	0,68	0,20	0,30	0,05	0,14	42,41
		After	0,81	0,10	0,12	0,02		

From the results mentioned above, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game h2=0.12% compared to the baseline levels h1 = 0.30%, but this rate remains above 15%. This explains why the game did not reduce the

gap that existed before the game, which explains why the learning did not have an "equity" effect. In other words, the differences in the levels of the skills of the students participating in the research are not reduced subsequently, the game has not participated in a greater "sharing" of skills. According to the results, we can still see that there is a positive learning effect (average relative gain) on the feeling of self-efficacy with a relative gain GRM= 42.41% (greater than 40%). This indicates that the students participating in the game feel that they have made real progress during the game with regard to the "Deutsche Straße Game Content: Game Card Content".

Table 6: Effect of "Deutsche Straße Game Content: Map Content" on students' "written" language skills

Factors	Sub-factors	Date	Statistical analysis					
			Average	Standard Deviation	Covariance	Standard Error	Average Gross Gain	Average Relative Gain
Map Content		Before	0,75	0,22	0,29	0,05	0,09	36,64
		After	0,84	0,12	0,14	0,03		

From the results mentioned above, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game h2 = 0.14% compared to the baseline levels h1 = 0.29%, but this rate remains above 15%. This explains why the game did not reduce the gap that existed before the game, which explains why the learning did not have an "equity" effect. In other words, the differences in the levels of the skills of the students participating in the research are not reduced subsequently, the game has not participated in a greater "sharing" of skills. According to the results, we can still see that there is an insufficient learning effect (average relative gain) on the feeling of self-efficacy with a relative gain GRM= 36.64% (less than 40%). This indicates that the students participating in the game do not feel that they have actually made progress during the game in terms of "total game content".

Table 7: Effect of "Total Deutsche Straße Game Content" on students' "written" language skills

Factors	Sub-factors	Date	Statistical analysis					
			Average	Standard Deviation	Covariance	Standard Error	Average Gross Gain	Average Relative Gain
Total game content		Before	0,68	0,20	0,29	0,05	0,13	41,15
		After	0,81	0,10	0,12	0,02		

From the results mentioned above, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game h2 = 0.12% compared to the baseline levels h1 = 0.29%, but this rate remains above 15%. This explains why the game did not reduce the gap that existed before the game, which explains why the learning did not have an "equity" effect. In other words, the differences in the levels of the skills of the students participating in the research are not reduced subsequently, the game has not participated

in a greater "sharing" of skills. According to the results, we can still see that there is a positive learning effect (average relative gain) on the feeling of self-efficacy with a relative gain GRM= 41.15% (greater than 40%). This indicates that student participants in the game feel that they have actually made progress during the game with regard to the "total game content".

Table 8: Effect of "Total Deutsche Straße Game Content" on Sense of Competence

Factors	Sub-factors	Date	Statistical analysis					
			Average	Standard Deviation	Covariance	Standard Error	Average Gross Gain	Average Relative Gain
Sense of Competence		Before	2,61	0,41	0,16	0,10	0,58	41,35
		After	3,18	0,37	0,12	0,09		

From the results mentioned above, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game h2 = 0.12% compared to the baseline levels h1 = 0.16%, but this rate remains above 15%. This explains why the game did not reduce the gap that existed before the game, which explains why the learning did not have an "equity" effect. In other words, the differences in the levels of the skills of the students participating in the research are not reduced subsequently, the game has not participated in a greater "sharing" of skills. According to the results, we can still see that there is a positive learning effect (average relative gain) on the feeling of self-efficacy with a relative gain GRM= 41.35% (greater than 40%). This indicates that student participants in the game feel that they have actually made progress during the game with regard to "Sense of Competence".

5. Discussion and Conclusion

In this study, several methods were used to calculate the effect of serious games as an innovative model in the field of non-formal education, especially for a non-formal education.

Overall, the results show that there is a positive learning effect (average relative gain) of Deutsche Straße game content on students' "written" language skills. This indicates that students feel that they have actually made progress after the game.

In fact, the problem situation in our game occupies a central place where each player tries to determine the synonyms of each unknown word in an adequate way by mobilizing different cognitive resources acquired before and during the game. Jonnaert (2002) defines the concept of competence as "*a set of resources that an individual mobilizes in a situation to succeed in an action".*

According to Bouderault (2002), a skill is knowledge (knowledge, know-how, interpersonal skills) that can be mobilized to solve a problem situation. Studies by Perrenoud (2013) show that competence lies in "*the ability to mobilize various cognitive resources to deal with a type of situation*".

Our result is consistent with several studies. According to the Council of Europe (2000), non-formal education refers to all planned and structured individual and social education programmes and processes for young people aimed at improving a set of skills and competences, outside the formal educational curriculum. According to Houcine (2011), they have a pedagogical purpose that explains the "*objectives of training, information or the acquisition of skills*". In addition, games with a positive reinforcement system, such as earning points, promote players' self-esteem and self-confidence.

According to Sanchez (2011) Michael *et al.* (2005): "*Any game whose primary purpose is other than mere entertainment*". So, every game, regardless of its nature or specificity, that has a serious character automatically becomes a serious game. Malone's Studies (1981); Wastiau *et al.*, (2009); Wix, (2012) show that Serious Games can increase motivation for students. Indeed, an adapted game gives the student regular feedback on his actions, thus maintaining his motivation (Whitton, 2011). In general, previous studies show that serious games improve learning: people learn more, on average, in situations where they are used than in those where they are not (Clark, Tanner-Smith, & Killingsworth 2016).

Despite the overall progress in the game, but in particular, it is noticeable that the level of game content "Deutsche Straße" especially at the level ": content of the map" shows that there is no positive learning effect (average relative gain) This indicates that the students feel that they have really progressed after the game. This result can be explained by the content analysis of geographical maps, which contains two main components, which are "the numbers" and "the federal states of Germany". It can be explained the insufficient progress of learning by previous knowledge of the numbers by the participants since they are the same given the universal aspect of the number and the difference is only found is in the writing in letters of the numbers. As far as the federated states of Germany are concerned, these are proper nouns, so we don't expect much difference since the pronunciation of proper nouns is almost the same all over the world, especially the names of cities compared to the names of countries.

However, our result is not consistent with several studies that conclude that there is no evidence for the effectiveness of serious games (Girard, Ecalle, & Magnan, 2012), and the probability of finding a positive result is greater in lower-quality studies (Wouters *et al.* 2013).

In addition, studies by Ruggil, A and McAllister (2012) denounce their perversity: for them, games are complex and this complexity works against pedagogy. They promote short-term educational gains by sacrificing the acquisition of useful lifelong learning processes. They take up a lot of time, and the school cannot afford to waste this money at the expense of education. Studies by Linderoth (2010) and Hock-Koon (2012) show that the ability to progress in a game does not ensure learning. Again, studies by (Linderoth, 2010) show that the goal of a Serious Game is to give immediate pleasure without seeking a result beyond the game.

Regarding the effect of "Total Deutsche Straße Game Content on the feeling of competence", the results show that there is a positive learning effect (average relative gain). This indicates that students feel that they have actually progressed after the game

in terms of sense of competence. A key advantage of Serious Games where the learner finds himself in a situation of experimentation in which he is invited to exercise his thinking skills. Most Serious Games rely on a trial-and-error learning mode: the learner mentally constructs a "hypothesis" before testing it in the game, which then gives them positive or negative feedback. This can increase the feeling of self-efficacy, especially in positive experiences because the active experience of mastery (lived experience) is one of the main sources of feeling competent, According to Nagels (2005), "*the more successful an individual is in experimenting with a given behavior, the more he or she will be led to believe in his or her personal abilities to accomplish the requested behavior*."

The use of pre-experiment testing can make the task easier: the game is not too difficult for a beginner, and we have eliminated from the beginning any population with a previous knowledge of the German language, facilitating the establishment of Proximal Developmental Zones (Vygotsky, 1985). For this reason, motivation has been guaranteed, on the one hand, since the game is not too easy, and a minimum of probable success since the game is not too difficult for the learner and all of this can increase the feeling of competence. An easy success or failure under impossible conditions will not have a direct consequence on the MS (Nagels, 2005). And this is consistent with the principle of Proximal Development Zones.

Our result is consistent with several studies by Barr (2012). After six months of using the game in class, she observes that the game encourages students to work together: the game encourages communication and collaboration between students. The spirit of competition in the game increases the feeling of competence through vicarious experience that manifests itself *"a learning that is based on the phenomenon of social comparisons, that is, on observation*". Observing peers experiencing a previously conflictual situation without controversy can influence and reinforce the observers' own belief in their ability to succeed (Rondier, 2004).

According to studies by Fourquet-Courbet (2015), serious games improve self-efficacy (Bandura, 1986), i.e. people's belief in their ability to mobilize the resources necessary to master certain situations. There are several characteristics that positively influence the player's self-efficacy.

First, because of their repetitive nature, serious games encourage the player to persevere to solve the problem and to win. In this way, they help to increase one's self-efficacy and confidence in one's ability to perform the "right" behavior in real life (Peng & Liu, 2009).

So, perseverance is an essential element of serious games and this is consistent with the studies of Bandura, (1995) who shows that the feeling of competence reinforces intrinsic interest and involvement in activities. Secondly, the challenges and challenges offered to the player in serious games help to motivate him intrinsically and encourage him to set goals throughout the game and subsequently increase his self-efficacy (Malone, 1981). Finally, well-designed feedback given in real-time allows the player to evaluate his performance and test alternative solutions and strategies: the personal relevance of the serious game and the player's self-efficacy increase (Schunk, 1987). This facilitates the

transfer of game skills and knowledge into real life (Blumberg *et al.*, 2013) and the player's sense of competence (Ryan & Deci, 2001). Built-in general feedback at different points in the game) would also positively increase the player's sense of self-fulfillment (Thompson *et al.*, 2008) while taking into consideration that verbal persuasion is among the main sources of feelings of competence. (Rondier, 2004).

According to studies by Fourquet-Courbet (2015), serious games encourage players to solve "playful problems" in order to provoke behavioral, socio-cognitive and socio-emotional changes. Knowing that the concept of a sense of competence is an essential element of socio-cognitive theory. In addition, serious games reduce the risk of weariness and boredom caused by the repetition of the same actions (Lee *et al.*, 2009).

However, our result does not agree with several studies such as Maurer, 1994, which shows a "concentration deficit" when the focus is on aspects of the situation that are secondary to the main task. In other words, it shows that the main or formal aspect of the game is a main element of concentration and motivation.

This study makes several contributions that are reflected on several levels. In terms of the originality of the research, the design of a serious game intended to teach the German language is a very original concept, especially for a non-classical language, and at the same time, gives great importance in student life, whether in scientific research or for the job market abroad. In addition, the importance of serious play, which can improve learners' psychological and social quality of life (Renaud, 2018)

While measuring the interest of our research, we can recognize some limitations: The research is limited to a limited number of populations and the sample belongs to almost a single faculty. In addition, each participant performs a single trial, which is relatively insufficient, knowing that repletion is an essential element in learning.

For all these reasons, we conclude that our research opens up several perspectives: first, to expand the research in several faculties in different universities so that the project becomes a national project. Then, increase the population number and the number of repetitions for each participant to ensure more learning (Bugmanss *et al.*, 2015). Finally, the integration of serious games into the formal training program for their psychological and social benefits.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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