



## EFFECT OF ACADEMIC SPECIALIZATION IN ICT ON THE ACQUISITION OF LANGUAGE SKILLS IN THE GERMAN LANGUAGE: THE CASE OF EDUCATIONAL SERIOUS GAME<sup>i</sup>

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### Abstract:

This study aimed to evaluate the effect of academic speciality in ICT on the acquisition of language skills in the German language in the case of Serious Game education in a non-formal education setting. A total of 23 students from different state universities of the University of Sfax, aged between 21 and 24, participated in an Educational Serious Game session through a game called "Deutsche Straße". The students were divided into groups of 4 players for each game session, which lasted between 30 minutes and an hour. A 107-item German word learning assessment questionnaire in the form of a multiple-choice question called "Deutsche Straße Quiz". This questionnaire was administered before the intervention (diagnostic assessment) and immediately after each session (summative assessment). In addition, a satisfaction questionnaire was used to measure the feeling of competence (Dumont *et al.*, 2000). The results showed an average relative learning gain in favour of non-ICT students compared to ICT specialists. These results suggest that the digitization of Educational Serious Game can be an effective way of reading

<sup>i</sup> AUSWIRKUNGEN DER AKADEMISCHEN SPEZIALISIERUNG AUF IKT DER ERWERB VON SPRACHKENNTNISSEN IN DER DEUTSCHEN SPRACHE: DER FALL PÄDAGOGISCHES SERIOUS GAME

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comprehension of German for all students of any speciality in a non-formal education setting at the university. In other words, the creation of an Android application so that the game is accessible in smartphones and subsequently ensures more influence.

**Keywords:** information and communication technologies, educational serious games, language skills, non-formal education

**Abstrakt:**

Ziel dieser Studie war es, den Effekt der akademischen Spezialisierung auf IKT auf den Erwerb von Sprachkenntnissen in der deutschen Sprache im Falle von Serious Game-Unterricht in einem non-formalen Bildungsumfeld zu bewerten. Insgesamt 23 Studenten verschiedener staatlicher Universitäten der University of Sfax im Alter zwischen 21 und 24 Jahren nahmen an einer Educational Serious Game-Sitzung mit dem Spiel "Deutsche Straße" teil. Die Schüler wurden für jede Spielsitzung, die zwischen 30 Minuten und einer Stunde dauerte, in Gruppen von 4 Spielern eingeteilt. Ein Fragebogen zur Bewertung des Lernens von deutschen Wörtern mit 107 Punkten in Form einer Multiple-Choice-Frage namens "Deutsche Straße Quiz". Dieser Fragebogen wurde vor der Intervention (diagnostische Bewertung) und unmittelbar nach jeder Sitzung (summative Bewertung) durchgeführt. Zusätzlich wurde ein Zufriedenheitsfragebogen verwendet um das Gefühl der Kompetenz zu messen (Dumont *et al.*, 2000). Die Ergebnisse zeigten einen durchschnittlichen relativen Lerngewinn zugunsten von Nicht-IKT-Studierenden im Vergleich zu IKT-Spezialisten. Diese Ergebnisse deuten darauf hin, dass die Digitalisierung von Educational Serious Game eine effektive Möglichkeit zum Leseverständnis von Deutsch für alle Studierenden aller Fachrichtungen in einem nicht-formalen Bildungsumfeld an der Universität sein kann. Mit anderen Worten, die Erstellung einer Android-Anwendung, damit das Spiel auf Smartphones zugänglich ist und anschließend für mehr Einfluss sorgt.

**Schlüsselwörter:** Informations- und Kommunikationstechnologien, pädagogische Serious Games, Sprachkenntnisse, non-formale Bildung

## 1. Introduction

Information and communication technologies is the "*set of technologies resulting from the convergence of computing and advanced multimedia and telecommunications techniques, which have enabled the emergence of more efficient means of communication, by improving the processing, storage, dissemination and exchange of information*". Adapted from Cynthia Fleury (2015). Digital tools have the ability to personalize programs since each person can learn at his or her own pace according to his or her own skills. Studies related to the perspective of ICT as cognitive tools focus on modes of use, interaction structures and contents. (Coco, 2008). The ICT field has shifted to several areas, including Educational Game Serious Games. Serious Games can be in digital form, like Android apps; also, they can

be in paper form, like Monopoly and Scrabble. The latter allows you to develop several skills, including logistics skills (Grimal, 2017).

A serious game is an activity that presents an artificial situation in which one or more players, placed in a position of conflict (confrontation) with other players or all together (cooperation) against other forces, are governed by rules (procedures, controls and closures) that structure their actions with a view to a specific goal, i.e. to win (winner vs. loser), to be victorious (against chance, the computer, one or more players) or to take revenge against an opponent. (Sauvé *et al.* 2007).

Our research aims to determine the effect of academic specialization in ICT on the acquisition of language skills in the German language: the case of Educational Serious Game in a non-formal education setting.

## 2. Materials and Methods

### 2.1 Participants

A total of 23 students between the ages of 20 and 27 who do not know the German language were recruited to participate in the study. Among the participants were 13 girls and 10 boys from three different Tunisian public universities (Table 1).

**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 who participated in the game had no experience in the German language but voluntarily participated in a non-formal setting, i.e. outside the formal classroom. This Serious Game is called "Deutsche Straße" knowing that all students have no experience in the German language. 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, a quiz or questionnaire corrector and a general coordinator.

**Table 2:** Characteristics of the Participants

Participants (n)	23
Age (years)	23,2

## 2.2 Procedure

A sense of self-efficacy influences achievement and well-being in many ways. The Self-Efficacy Measure Scale is a 10-item psychometric scale that is designed to assess positive beliefs to cope with a variety of challenging demands in life. The scale was originally developed in German by Matthias Jerusalem and Ralf Schwarzer in 1981 and has been used in many studies with hundreds of thousands of participants. The scale is available in 33 languages.

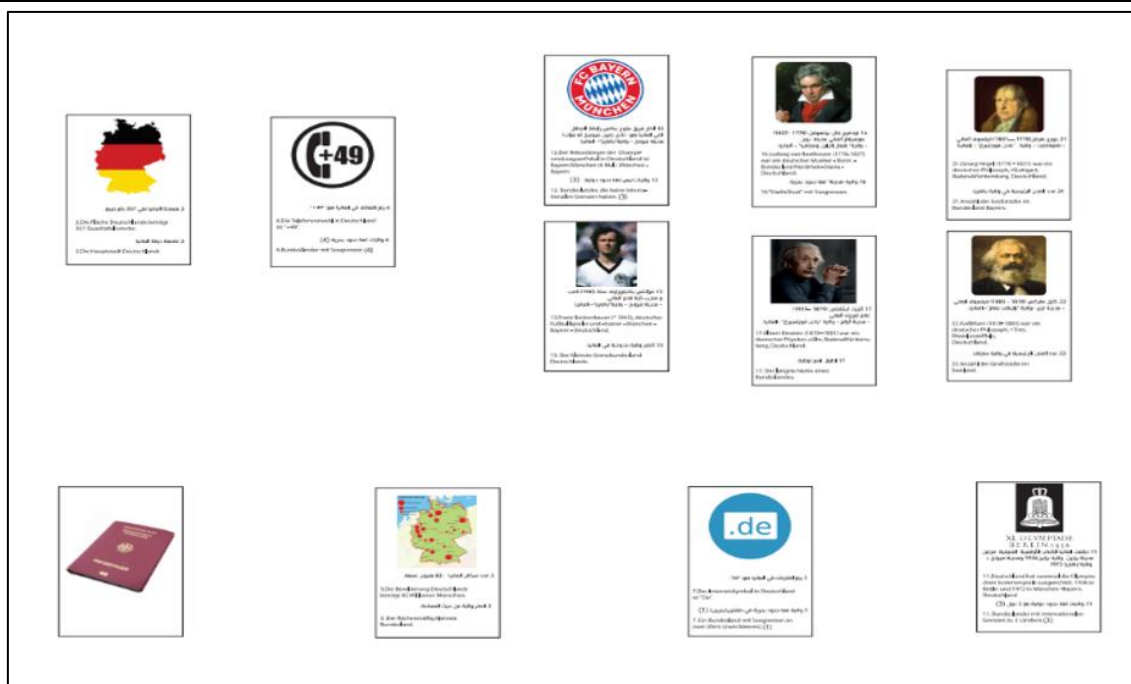
French adaptation of the general scale of self-efficacy is readily reproduced by Dumont *et al.* (2000). This questionnaire has been validated in the academic world by Saleh (2016). The 10 items are accompanied by a Likert-type scale (Attitude Scale comprising 1 to 4 degrees) by which the individual was asked to express his or her degree of agreement or disagreement with a statement. These items allow us to affirm the degree of MS according to the answer choice: 1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Totally true

Inspired by Gérard's (2003) methodology for evaluating the effectiveness of training, the respondent performs a self-assessment of mastery of these skills, which consists of estimating his or her level of effectiveness on a scale of 1 to 4 before and after the game. 1 = Not at all true 2 = Barely true 3 = Moderately true 4 = Totally true. Before starting the experiment, all participants were given an introduction to the objective of the game, game rules and different perspectives.



**Figure 1:** Game Content "Deutsche Straße": Example Street

As for the game, it is made up of a street that represents the different embassies and organizations, the different traffic laws and a geographical map that encompasses the different German federal states. According to the following graph:



**Figure 2:** Contents of the Red and Yellow Card

During the game in the first half of the street, each participant can draw a red card which is called "information and question" This card consists of two parts: one part represents information about German culture and one part 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 this time, each participant can earn points and lose points, and from these points, he can buy a federal state card. The participant who collects the maximum amount of money from the federal states is considered a winner.

The game ends when a participant collects the maximum number of states. After the questionnaire was set up and before the sample survey was launched, a pre-test was conducted. Our first concern in the pre-test was to ensure as much as possible that the questions were well understood by the interviewees. Therefore, we applied this test to a small sample belonging to the survey universe but which 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.

This tool rotates on 3 axes:

- Factor 1: Street content,
- Factor 2: Game map content,
- Factor 3: Map content.

Each factor has several sub-factors, such as embassies and organizations, signs and traffic lights. To assess the mastery of the German words written in the game, the respondent takes the self-assessment, which consists of choosing between 3 answers, a, b and on a multiple-choice question that represents the words written in the game. This questionnaire is composed of 3 factors, represents the 3 components of the game, and each skill has statements according to the table below. The questionnaire items are classified in the questionnaire in the following order (see Table 3):

**Table 3: Order of Items in the Scale**

N°	Factors	Sub-factors	Numbers
Game Content	Street Content	Embassies & Organizations	12
		Signs & Traffic Lights	16
	Game Card Contents	Title of the Cards	5
		Colors	3
		Professions	9
		Mathematical Words	8
		Geography	22
		Sport	7
		Contents of the Maps	Numbers
	The Federal States of Germany		7

The distribution of the questionnaires will take place in January 2024 in the various universities of the University of Sfax. The questionnaires were distributed to the students during their free time in class. In addition, we have explained a few items to help respondents choose the answer that is right for them. The answers are in the form of a multiple-choice questionnaire (MCQ) followed by 3 proposed answers, i.e. are trichotomous items.

### 2.3 Statistical analysis

For response processing, statistical analysis is carried out on a microcomputer using Excel software. In the statistical analysis, all students with previous knowledge of the German language were eliminated. All statistics are considered significant for a probability threshold of less than  $\alpha=0.05$ .

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 reasonably accurate estimate of the pedagogical effectiveness of the training. According to Gérard (2003), there is a positive learning effect when this relative gain is greater than 40%.

According to Gerrard (2003), "its advantage over standard deviation is that it gives a percentage that allows the reference to the mean to be removed." 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 Gerrard (2003), "comparison of heterogeneity rates shows that training has reduced the disparity that existed at the outset. This means that the learning had

an 'equity' effect, in that the skills gaps between narrowed participants and the training therefore contributed to a greater 'sharing' of skills.

### 3. Results

**Table 1:** Effect of Academic Specialization in Information and Communication Technologies on the Acquisition of German Language Skills through the Educational Serious Game in a Non-formal Education Setting

Language Skills				
Academic Specialty	ICT Specialists		Non-ICT specialists	
Period	Before the Game	After the Game	Before the Game	After the Game
Avg	0,70	0,80	0,67	0,82
ECAR Type	0,13	0,14	0,24	0,08
CV	0,19	0,17	0,35	0,10
Standard Error	0,05	0,03	0,07	0,02
GRB	0,10		0,15	
GRM	32,38		45,49	

First, according to the results mentioned above regarding the effect of the academic speciality in information and communication technologies, we can see that the rate of heterogeneity (coefficient of variation) decreased after the game  $h_2=17\%$  compared to the baseline levels  $h_1 = 19\%$ , 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 more significant "sharing" of skills. According to the results, it can still be seen that there is a positive learning effect (average relative gain) on the acquisition of language skills in German with a relative gain  $GRM= 32.38$ , but this rate remains insufficient for the acquisition of a skill. (less than 40%). This indicates that student participants in the game do not feel that they have actually made progress during the game with regard to the acquisition of language skills.

Then, according to the results mentioned above with regard to students who are not specialists in information and communication technologies, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game  $h_2=10\%$  compared to the baseline levels  $h_1 = 35\%$ , (less than 15%). This explains why the game reduced the gap that existed before the game, which explains why the learning had an "equity" effect. In other words, the differences in the levels of skills of the students participating in the research are reduced, and the game has subsequently 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  $GRM= 45.49\%$  (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 acquisition of language skills"

Finally, then, according to the results mentioned above, it can be seen that there is a difference between the acquisition of language skills in the German language through the Educational Serious Game in favor of non-specialist students in information and communication technologies with average relative gain GRM= 45.49% compared to the non-specialist students in information and communication technologies with average relative gain with GRM=32.38.

**Table 3:** Effect of Academic Specialization in Information and Communication Technologies on Students' Sense of Competence with Regard to the Educational Serious Game

Sense of Competence				
Academic Specialty	ICT Specialists		Non-ICT specialists	
Period	Before the Game	After the Game	Before the Game	After the Game
Avg	2,68	3,18	2,56	3,18
ECAR Type	0,43	0,34	0,42	0,40
CV	0,16	0,11	0,16	0,13
Standard Error	0,17	0,08	0,13	0,12
GRB	0,50		0,62	
GRM	37,97		43,04	

First, according to the results mentioned above regarding the effect of the academic specialization in information and communication technologies on students' sense of competence with regard to the Educational Serious Game, we can see that the rate of heterogeneity (coefficient of variation) decreased after the game  $h_2=16\%$  compared to the baseline levels  $h_1 = 11\%$ , (less than 15%). This explains why the game reduced the gap that existed before the game, which explains why the learning had 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 students' sense of competence with regard to the Educational Serious Game with a relative gain GRM= 37.97. However, this rate is still insufficient for the acquisition of a skill. (less than 40%). This indicates that the student participants in the game do not feel that they have actually made any progress during the game in terms of the student's sense of competence vis-à-vis the Educational Serious Game.

Then, according to the results mentioned above with regard to non-ICT students, it can be seen that the rate of heterogeneity (coefficient of variation) decreased after the game  $h_2=16\%$  compared to the baseline levels  $h_1 = 13\%$ , less than 15%. This explains why the game reduced the gap that existed before the game, which explains why the learning had an "equity" effect. In other words, the differences in the levels of skills of the students participating in the research are reduced, and the game has subsequently 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= 43.04% (greater than 40%). This indicates that student participants in the game feel



that they have actually made progress during the game in terms of "the students' sense of competence vis-à-vis the Educational Serious Game".

Finally, then, according to the results mentioned above, we can see that there is a difference between the student's sense of competence vis-à-vis the Educational Serious Game is in favor of non-specialist students in Information and Communication Technologies with average relative gain GRM= 43.04% compared to non-specialist students in Information and Communication Technologies with average relative gain with GRM=37.97.

#### **4. 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 non-formal education. Overall, the results show that the acquisition of language skills in the German language through the Educational Serious Game is in favor of students specializing in information and communication technologies. It is explained that the student specialist in tic retrieve in a usual environment rich in serious games, whether it is Android applications or, mobile applications or web applications. A key advantage of Serious Games is that they provide the learner with a space for experimentation in which he or she is (Coco, 2008).

According to Bourassa (1999), learning is effective when it is experiential and is in continuity with the learner's past experiences. The learner is "immersed" in an environment in which he will find his own path and develop his own knowledge. This may be due to intrinsic motivation, where the student who is not a specialist in ICT finds himself far from being in daily interaction with serious games, especially digital ones.

In addition, it is also noticeable that there is a significant difference between the student's sense of competence vis-à-vis the educational serious game in favor of students who do not specialize in information and communication technologies compared to students who do not specialize in information and communication technologies.

This result can be explained by the fact that the specialist will find this game to be perfect fun with simplicity and facility far from digital and digital complexity. According to Pomian, J. (2009). This is how learning and education evolve into fun and ease. This is reminiscent of New Age approaches that advocate "waking up your inner child."

The results showed an average relative learning gain in favour of non-ICT students compared to ICT specialists. These results suggest that the digitization of Educational Serious Game can be an effective way of reading comprehension of the German language for all students of any speciality in a non-formal education setting at the university. In other words, the creation of an Android application so that the game is accessible on smartphones and subsequently ensures more influence.

#### **Conflict of Interest Statement**

The authors declare no conflicts of interest.

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