Evaluation of a Serious Game for Young Software Engineering Graduates: Interviewing Skills and Soft Skills

Semira Maria Evangelou
Computer engineering and Informatics
University of Patras
Patras, Greece
evangelou@ceid.upatras.gr

Vangelis Kapsoulakis
Computer engineering and Informatics
University of Patras
Patras, Greece
kapsoulakis@ceid.upatras.gr

Michalis Xenos
Computer engineering and Informatics
University of Patras
Patras, Greece
xenos@ceid.upatras.gr

***Abstract*— Serious Games have proved to have instructional potential due to their ability to present realistic simulations of real-life situations. In this study, a serious game called "Galaxy Solutions" was developed. This game simulates all the stages of the recruitment process. It starts when the player is searching for vacancies and submitting applications, continues to the interview process, and concludes at the last stage, in which a company named "Jupiter Solutions" hires the player. Consequently, new challenges unfold in the working environment. The main objective of this game is to help graduates acquire basic interview skills and be aware of the whole process by making the learning experience more enjoyable and engaging. Throughout the game, the player must make decisions through multiple-choice actions and dialogue, and all these decisions affect the character's events in the future. The game was evaluated by 105 students, and it was found usable by all the students, regardless of their success level in the game, and had a statistically significant learning effect, as the pre-posttest analysis revealed.**

Keywords— software engineering, interviewing skills, serious games

I. INTRODUCTION

Interviewing for a new job can be an overwhelming experience. Everyone hopes that qualifications speak for themselves, but sometimes that may not be enough to make someone stand out from a pool of equally talented candidates. There are also many cases where candidates are unaware of the process, leading to poor performance. It is essential for young graduates, in addition to hard skills, to spend time developing a few key interview skills and getting familiar with the process. By learning the process and creating an authentic connection with the interviewer, someone can move one step closer to landing the job they pursue.

Over the years, there has been a growing interest in the use of technological tools, such as so-called Serious Games. Many institutions have been investing in these kinds of tools to improve the learning experience of students and make learning content delivery more effective while providing opportunities for them to develop their skills [1]. Serious games are used in many different fields [2] as they can be applied to a wide range of problems and challenges and are designed for an explicit and carefully designed educational purpose that goes beyond fun or entertainment.

In this work, we developed a serious game aimed at fresh software engineering graduates looking for their first job. The game allows students to have a first-hand experience of searching, applying, interviewing for jobs, and finally getting hired. The goal of the game is to prepare students for the whole process and help them develop the necessary soft skills. Our research questions focus on whether such a game is a suitable and appropriate medium for educational purposes. We evaluate whether the game can help students develop their knowledge about the game's topic. We also investigate whether it has had a positive impact on student learning and whether it is perceived as useful and easy to use. Finally, we examined if such a serious game really entertains players and makes learning fun.

The rest of the paper is structured as follows: Section 2 presents a brief literature review. Section 3 presents the game concept and some game elements in detail. Section 4 presents the results from the evaluation of the game that involved 105 software engineering students. Finally, section 5 outlines conclusions and briefly presents future goals.

II. LITERATURE REVIEW

Nowadays, the job searching process can be a demanding procedure that usually consists of a round of interviews. A job interview is a two-way discussion rather than an interrogation and can be defined as a conversation in which a person interested in working in an organization and an employer exchange information [3]. On one hand, the interviewer will try to determine whether an applicant will be an asset to the organization or not. On the other hand, the applicant's goal is to present themselves as the best candidate for a position.

A significant number of people find the job search process stressful in terms of all the tasks and preparation activities they must do [4]. Especially for fresh software engineer graduates who have no previous experience with the process while they are familiar with many technologies, and they mastered some primary coding languages, they haven't developed some basic interviewing skills. As a result, they can quickly get overwhelmed. It would therefore be very useful for them to learn and experience an interview process before going out on a job search.

The use of serious games is of great interest to train future professionals regarding their soft skills [4]. There are many games available to students to help them develop a basic understanding of the software engineering field [5, 6]. Also, a large number of games aim to develop the hard skills of software developers [7, 8]. However, in a job interview, in addition to technical knowledge, one must also possess some soft skills. This way it will perform better and with less stress.

To bridge this gap, it is vital to develop serious games for software engineering students related to the recruitment process for a job. In this way, students will have access to important knowledge about recruitment requirements and will be informed about the necessary steps. Such games could

XXX-X-XXXX-XXXX-X/XX/$XX.00 ©20XX IEEE

```
init:
default test_nav = 0
screen achiviments:
imagebutton:
idle "navigation_bar/nav_bar_toggle.png"
hover "navigation_bar/nav_bar_toggle_hover.png"
selected_idle "navigation_bar/nav_bar_toggle_hover.png"
selected_hover "navigation_bar/nav_bar_toggle_hover.png"
align(0.0, 0.02)
action [If(renpy.get_screen("nav_bar")==None,true=Show("nav_bar") ,false=Hide("nav_bar")
),SetVariable("test_nav", 1),If(test_nav == 1,SetVariable("test_nav", 0))]
label start:
call screen disclaimer
play music "audio/char_create_sound_NO_COPYRIGHT.mp3" fadein 2.0
call screen dress_player with dissolve
stop music fadeout 3.0
label intro:
scene room
python:
player_name = renpy.input("What is your name?                    (Only english
characters.)",allow="qwertyuiopasdfghjklzxcvbnmQWERTYUIOPASDFGHJKLZXCVBNM
" ,length=14)
player_name = " ".join(player_name.split()) #get rid of the duplicate whitespaces
player_name = player_name.capitalize()
show screen achiviments
if gender_choice==1:
"[player_name] notices there is a menu in the top-left corner. He can hover over each level on
REWARDS to see how to collect the required stars and gems to unlock GAME ROOM."
show male_char: pos(0, 120)
zoom 1.5
with moveinleft
elif gender_choice==2:
"[player_name] notices there is a menu in the top-left corner. She can hover over each level on
REWARDS to see how to collect the required stars and gems to unlock GAME ROOM."
```

Fig. 1 Code used for the "Galaxy Game"

simulate the entire recruitment process, to allow students to experience it in a playful and motivating way. Serious games that promote simulation learning are rising in popularity as alternative supplementary learning approaches across all disciplines at all levels [9]. A previous study evaluated a virtual job interview training game whose main purpose was to help young people that are facing difficulties in finding a job [10]. The system includes game elements and job interview simulation mechanics. They concluded that virtual environments have great potential to be used as job interview training instruments on a large scale, extending current teaching practices.

Various educational games have been introduced that can be used to train the soft skills of engineering students. A game called "My life as a Software Engineer" gives students the opportunity to face situations and challenges related to the software engineering work environment [11]. Also, another game called "ethical dilemmas" focuses on technological as well as ethical dilemmas that software engineers may face during their careers [12].

In our study, we developed a serious game called "Galaxy Solutions" to provide an immersive and interactive training experience for job interview skills. The game simulates the entire recruitment process, from job search and application to the final stages of being hired by a virtual company named Jupiter Solutions. Players are required to make decisions through multiple-choice actions and dialogue options, and the consequences of their choices affect the character's events in the future.

There is a growing recognition of the importance of soft skills development among higher engineering courses [13]. While traditional teaching methods that focus on theoretical concepts play a critical role in building students' knowledge, there is a need for practical and hands-on experiences to supplement these methods. Our game offers a practical and hands-on learning experience that supplements existing practices. By engaging in simulations of the recruitment process, students can develop a better understanding of what to expect during interviews and gain the opportunity to practice their skills in a safe environment. The game offers an opportunity for students to build their confidence and acquire basic interview skills in an enjoyable and engaging way.

Overall, our serious game provides an effective approach to teaching interview skills. It offers a practical and interactive experience that complements traditional teaching methods and can help students succeed in the job market. The game can help students to acquire practical knowledge and build their confidence in an enjoyable and engaging way.

III. The Game

A. Game Story

The serious game presented hereinafter is called "Galaxy Solutions" and was developed in a visual novel engine (RenPy) that allows the use of words, images and sounds to tell interactive stories that run on computers and mobile devices. An example of code used for the "Galaxy Game" is shown in Fig. 1. The game includes five levels and a "Game Room", and assumes the existence of a company, "Jupiter Solutions" which is a fictitious invention for the purposes of this study.

In "Galaxy Solutions," players step into the shoes of the protagonist and embark on a journey through the recruitment

Fig. 2 The player has a conversation with a non-player character

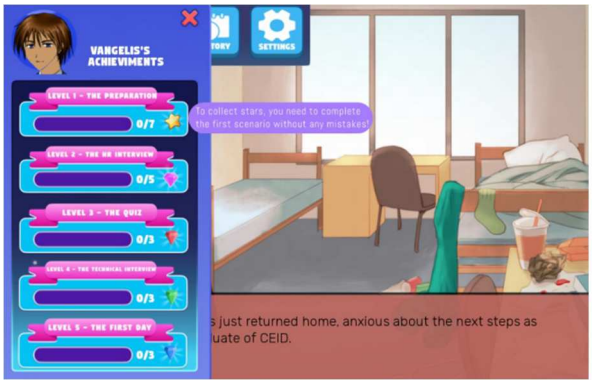

Fig. 3 Rewards the player collects during the levels

process. The first level involves the player applying for a job, with three options available: User Experience (UX) Designer, Junior Java Developer, and Junior Data Engineer. During this stage, the player is also provided with important information on the requirements for job applications, including the creation of a resume and cover letter. The second level involves an interview with the Human Resources (HR) department. In the third level, players face an assessment test, which leads to the fourth level, a technical interview. Finally, in the fifth and final level, the player is successfully hired by the company. Throughout the game, players gain a comprehensive understanding of the recruitment process and develop essential skills for job applications.

During the game, non-player characters are introduced to provide a dynamic and seamless progression of the game's story (Fig. 2). Before starting the game, players are prompted to create their avatar, which serves as their representation throughout the adventure. With a range of customization options for the character's appearance, players can personalize their experience. The story begins with the protagonist, freshly graduated and feeling uncertain about their future career path. As the game progresses, they encounter various challenges and dilemmas, requiring them to make important decisions that shape the outcome of the story. This engaging gameplay not only offers a thrilling experience but also serves to impart valuable lessons on decision-making and career exploration.

The game is designed with an educational purpose, allowing players to progress through each level regardless of the outcome. In the event of an unsatisfactory result, players have the option to either continue the game or replay the level. The game features a points and rewards system, where correct decisions and actions yield special points (Fig. 3). These points are represented by unique symbols and, when accumulated, unlock the game room, a special reward that incentivizes players to continue playing and improve their performance. The game room contains a selection of mini-games, designed to enhance the learning experience and make it even more enjoyable. This approach ensures that players have the opportunity to master the skills and knowledge taught through the game, motivating them to continue their progress until they achieve success.

B. Level 1: Applying for a Job

The game begins with the protagonist receiving a call from a close friend, Maria, who works for "Jupiter Solutions". Maria informs the protagonist of new job openings within the company. The player visits the company's website and explores the available job positions and their respective requirements. This is where the player makes their first decision, choosing which job to apply for. Each job has a unique progression path. The player can view detailed information on the job descriptions and requirements for each position. Next, the player proceeds to the job application, where they are asked to submit a resume and, optionally, a cover letter. Before submitting the application, the protagonist researches tips for creating an effective resume. To further educate the player, the game includes a brief quiz on resume-writing, which provides useful information and tips.

Upon completion, a pop-up screen displays the correct answers, and the protagonist proceeds to apply for their desired job position. They are presented with three resume options and three cover letter options, but only one combination is correct for each job. The chosen resume and cover letter should accurately showcase the player's qualifications and be relevant to the selected job. If an incorrect combination is chosen, a message appears to inform the player of the errors and offer another chance to choose. However, if the player selects the appropriate resume and cover letter on their first attempt, they earn the "star" reward, and a message appears explaining why the combination is suitable for the job.

The first level culminates in the protagonist receiving a call from the HR department at "Jupiter Solutions," inviting them for an initial interview. To aid in their preparation for the job search process, an informational window appears at the end of each level, offering valuable tips and advice.

C. Level 2: Interview with the Human Resources

The protagonist in the second level of the game is preparing for an interview, which can be conducted either virtually or in-person, depending on the job the player has selected. During the interview, which is facilitated by a virtual character named Tatiana, the player will be evaluated based on their answers to multiple choice questions. Tatiana's facial expressions will change in response to the player's answers, and the player will receive a diamond reward for correct answers. The hypothetical dialogue with Tatiana serves as an educational tool, highlighting mistakes to avoid in real-life job interviews. At the end of the level, the mistakes will be highlighted as tips for the player. The player is asked to answer a total of five questions, and a circular progress bar will fill up with each correct answer. The progress bar is shown in Fig. 4.

The five questions are:

- "Tell me about yourself and why you want to work with us."
- "What do you think is your greatest weakness?"
- "Where do you see yourself in 5 years?"

- "Tell me about a time when you had a conflict with a fellow student."
- "What is your ideal work environment?"

D. Level 3: Assessment

The third level begins with the protagonist having a conversation with Maria about their worries about not receiving a response from "Jupiter Solutions". This conversation is included to reflect the common scenario of companies taking longer than expected to reply. The protagonist then receives an email updating them on the progress of their application. The contents of the email are determined by the player's performance in the previous level.

Specifically, if the player answered three or more of the five questions correctly during the second level, earning at least three diamonds, they will receive an email from Jupiter Solutions stating their interest in continuing the recruitment process and inviting the player to participate in an assessment. On the other hand, if the player did not earn three diamonds, the email will inform them that Jupiter Solutions has decided to choose another candidate for that position. Regardless of the number of diamonds collected, the story will proceed to the protagonist studying for the assessment. They will then receive another email from Jupiter Solutions providing details about the assessment.

The assessment for each job position is unique. The player is given 10 minutes to complete the test. As an example, the test questions for the job position of a Java developer are displayed in Fig. 5.

At this stage of the game, the protagonist can earn a Ruby as a reward for points earned. In order to progress to the next level and unlock the game room, the player must collect at least two Rubies. Based on their performance in the assessment, the player will receive a corresponding message from "Jupiter Solutions" indicating whether they have passed or failed. Even if the player doesn't earn the required two Rubies, they have the option to either continue the game or repeat the level.

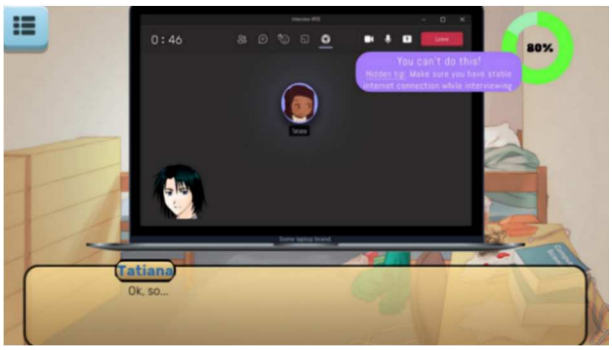

Fig. 4. The progress bar during the interview

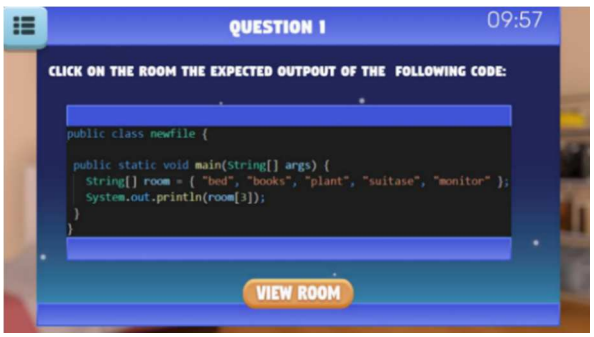

Fig. 5. Quiz test example

E. Level 4: Technical Interview

The protagonist engages in a call with John Kaps and David Antoniou, where John Kaps will conduct the technical interview and David Antoniou will observe. The questions posed to the protagonist will be tailored to the job position being applied for. John Kaps will ask three questions, and for each correct response, the protagonist will receive an emerald as a reward. To advance to the next level, the protagonist must earn at least two emeralds and meet the minimum requirement to unlock the Game Room. Upon completion of the level, "Jupiter Solutions" will notify the protagonist of their hiring outcome based on their performance in the interview. Should the protagonist fail to earn the required two emeralds, they will have the choice to either proceed with the game or repeat the level.

F. Level 5: Recruitment

After the technical interview, whether the protagonist successfully earned the two required emeralds or decided to proceed without them, the story continues with their hiring by company.

The fifth level presents the protagonist with three workplace dilemmas, each of which has a single correct solution. For every correct decision, the protagonist earns a sapphire, though sapphires are not necessary to unlock the game room or to be counted as a reward. This level remains the same for all job positions. The protagonist arrives at the offices of "Jupiter Solutions" where they are greeted by Mark, the project manager. Mark introduces the protagonist to the rest of the team and assists them in setting up their equipment.

At the end of their first day, the protagonist faces their first dilemma, in which they receive an email instructing them to open a link to activate the "Jupiter Solutions" account code, which they were previously unaware of. The correct course of action is to inform Mark about the email, allowing the protagonist to learn about phishing attacks.

G. Game Room

The Game Room consists of three planets, each of which features a different mini-game. The games must be played in succession, and the player must complete one game before moving on to the next. The first planet is a puzzle game where the player matches three or more identical gems. Breaking the gems results in new ones appearing in their place, and the more gems the player breaks, the more points they earn. The objective is to collect 400 points and complete the game. The second planet is a conversion game in which the player transforms a number from binary to decimal. They are presented with a digital clock that displays the time in binary and must determine the corresponding decimal time. For example, the time "1101:11011" would be "13:27" in decimal. Finally, on the third planet, the player must identify five differences between two pictures. After completing each mini-game, helpful interview tips are displayed on the screen.

IV. Evaluation

A. Participants and Context of the Evaluation

This serious game was used as an educational tool for the "Software Engineering" course in the Computer Engineering Department of the University of Patras. This course is a

compulsory course offered during the 4th year of studies. The Computer Engineering Department offers an engineering program with an integrated M.Sc. degree. The results presented hereinafter were collected during the 2021-2022 academic year. A total of 105 students evaluated the game. To evaluate the learning gain from the serious game, we carried out a 16-item knowledge test with students before (pre-test) and after (post-test) playing the game. To evaluate the students' perceptions on the Educational value of the game , the Enjoyment and the Usability of the game, we used a custom 7-item questionnaire to measure the educational experience of the game, a custom 5-item questionnaire to measure enjoyment and SUS [14] after the students played the game. After collecting all the data, we assigned a random ID to each player and deleted the names. There was no association between code and name, so all analysis was done anonymously.

The overall goals of the evaluation include the following research questions:

1) RQ1: Did the serious game produce a positive impact on students' knowledge acquisition?
2) RQ2: Did students find the game useful for learning?
3) RQ3: Did students find the game easy to use?
4) RQ4: Did students enjoy playing the game?
5) RQ5: Are there any differences in learning gain, perceived usability, enjoyment, and perceived educational effectiveness related to gender?
6) RQ6: Are there any differences in learning gain, perceived usability, enjoyment, and perceived educational effectiveness related to whether they unlocked the "Game Room"?

B. Evaluation Tools

To evaluate the serious game, we carried out a knowledge test with the students before (pre-test) and after (post-test) playing the game. In particular, the knowledge test was a 16-item questionnaire with multiple-choice questions with three or four possible answers each. Table III presents the questions included in this test. Students were asked to follow the rules displayed on the website and download the game and start to play only after completing the knowledge test and a few demographic questions. After that, students were left free to interact with the game and make their own decisions. The questionnaire and the game were available on the website for 3 weeks (11 April–1 May) including the easter holidays. During this period, they had no classes or other learning activities.

After finishing the game, the same test (post-test) was offered to them. Finally, they completed also:

- The standardized System Usability Scale questionnaire using the 5-point rating scale. The SUS provides an overall score regarding the usability of the game ranging from 0 to 100.
- Seven questions related to their educational experience caused by the game, using a 5-point rating scale. Table Ipresents these questions.
- Five questions related to their enjoyment while playing the game, using a 5-points rating scale. Table II presents the questions related the enjoyment.

TABLE I. ITEM EDUCATIONAL EXPERIENCE QUESTIONNAIRE

Educational Experience
1. The game was useful as an educational tool.
2. This game has helped me enrich my knowledge of the interview recruitment process.
3. This game helped me learn information on how to create my CV.
4. This game did not offer me any valuable knowledge.
5. This game could help me apply what I learned.
6. Overall, I am satisfied with the way I have learned through this game.
7. It will be more interesting than lectures only in class if instructors apply game-based simulated learning materials on their teaching.

TABLE II. ITEM ENJOYMENT QUESTIONNAIRE

Enjoyment
1. I think the game is fun.
2. I enjoy playing the game.
3. I feel bored while playing the game.
4. am likely to recommend this game to others.
5. If given the chance, I want to play this game again.

TABLE III. 16-ITEM KNOWLEDGE TEST

Knowledge test
1. Which of the following procedures would you choose to find a job?
2. What kind of information should appear at the top of a CV?
3. In a CV, how should the professional experience be listed?
4. In a CV, what is the preferred way to list professional experience and education?
5. When creating or updating your CV, what do you consider?
6. Along with my CV I can send:
7. Which of the following can be considered an interview process step for a computer engineer position?
8. How would you present yourself in an interview?
9. How would you answer the question "What do you consider to be your weaknesses?"
10. How would you answer the question "Can you describe a bad professional collaboration?"
11. How would you answer the question "What is your ideal work environment?"
12. If you were asked to answer a question to which you do not know the answer, how would you handle it?
13. How do you prepare yourself for a technical interview?
14. What is phishing?
15. As an employee, you receive an email with personal data of the company, how do you react
16. You have made a mistake in a task. How do you manage it?

TABLE IV. DESCRIPTIVE STATISTICS

	Mean	***Median***	***SD***	***95% CI***
Pre-test score (0-100)	74.75	75	15.22	[70.80 – 76.69]
Post-test score (0-100)	90.69	93.75	11.68	[86.78 – 91.30]
Normalized learning gain (%)	61.06	75.00	40.29	[53.26 – 68.86]
Educational exper-ience rating (1-5)	4.28	4.42	0.67	[4.15 – 4.41]
Enjoyment (1-5)	3.85	3.80	0.75	[3.70 – 4.00]
SUS score	79.23	80.00	12.24	[76.86 – 81.60]
Usability adjective rating score (1-7)	5.39	5.0	0.80	[5.23 - 5.54]

- The 7-point adjective rating scale statement with a rating scale from "Worst imaginable" to "Best imaginable" [15].

The internal consistency of all questionnaires was found to be high. The SUS questionnaire used to assess the usability of the game had a satisfactory internal validity (Cronbach's

alpha=0,751, N=10). The questions related to their educational experience with the game had adequate reliability for our dataset (Cronbach's alpha=0.857, N=7). Finally, the questions related to their enjoyment while playing the game had adequate reliability for our dataset (Cronbach's alpha=0,847, N=5). The 16-item questionnaire was found to have low (Cronbach's alpha=0,652, N=16), which was resolved after removing the question 12 and resulting in acceptable internal validity (Cronbach's alpha=0.714, N=15).**Error! Reference source not found.** TABLE IV presents the descriptive statistics of the dependent variables measured in this work (mean, median, standard deviation, and 95% confidence interval).

C. Learning Gain

Regarding the **RQ1** ("Did the serious game produce a positive impact on students' knowledge acquisition?"), to evaluate if the game had a significant learning effect on the students that played, we measured the differences in post-test scores compared with the pre-test scores, using the normalized gain as a metric, as well as comparing the pre-posttest results. The normalized gain can be defined as the difference between the post-test score and the pre-test score ('observed gain') divided by the difference between the max possible score and the pre-test score (measuring the 'amount of possible learning that could be achieved'). Of the overall 105 students who played the game, only 6 of them had negative ranks between the pre-test and the post-test, only 15 of them had the same score, while 84 of these students had positive ranks. This can also be observed from the average score of the normalized learning gain which was quite high (+61%).

Since for both the pre-test and post-test data the normality assumption was violated, as determined by the Shapiro-Wilk test, non-parametric methods were used for the analysis of the pre-posttest results for the learning game. A Wilcoxon signed-rank test revealed that there was a significant difference between the pre-test scores and the post test scores ($Z=7.562$, $p<0.001$). Thus, since the game caused a significant increase in the knowledge test scores, we could assume that it achieved its purpose as an educational tool.

D. Educational Usefulness

To evaluate the serious game concerning its usefulness (**RQ2**: "Did students find the game useful for learning?"), the students were asked to rate their educational experience and to comment if they have found the game a useful educational tool. Specifically, they rated the game very high on a 5-point Likert scale (Mean=4.28, SD=0.67). This score is relatively high and probably is an indication that the students perceived the "Galaxy Solutions" game as a useful educational tool.

E. Game Usability

Regarding the **RQ3** ("Did students find the game easy to use?"), using the SUS questionnaire, the students rated the game very high (Mean=79.23, SD=12.24). Since a SUS score above 68 is considered as 'above average' and scores above 80.8 are considered 'excellent' the game was found to be very usable by the students. Moreover, using the adjective rating scale statement, students' ratings were also rather high (Mean=5.39, SD=0.80), indicating that the game was considered "Good" (corresponding to 5 on the 1-7 scale).

From the results of both the SUS and the adjective rating scale, it is clear that the students found the game very usable, and they didn't face any usability-related issues while playing it.

F. Enjoyment While Playing

Regarding the **RQ4** ("Did students enjoy playing the game?"), the students were asked to rate their enjoyment while playing the game. The students rated the game above well on a 5-point Likert scale (Mean=3.85, SD=0.75). So, we could conclude that the students enjoyed playing the game. This score is relatively high and probably is an indication that the students found the game enjoyable and had a rich entertaining experience while playing.

G. Gender Differences

To investigate the **RQ5** ("Are there any differences in learning gain, perceived usability, enjoyment, and perceived educational effectiveness related to gender?") about differences in learning gain, perceived usability, perceived educational effectiveness and enjoyment related to gender we conducted a set of non-parametric tests since the normality assumption was violated, as determined by the Shapiro-Wilk test.

The two-tailed Mann-Whitney U test showed that the differences in the SUS score were not statistically significant ($U=1060.5$, $p=0.542$). Regarding learning gain, despite the fact that females had a higher score (Mean=66.32, SD=39.03) compared to male students (Mean=58.96, SD=40.86), the two-tailed Mann-Whitney U test did not show that the differences were statistically significant ($U=1010$, $Z=-0.982$, $p=0.326$). A two-tailed Mann-Whitney U test was also conducted to examine the educational effectiveness of the game related to gender. The test revealed that the differences were not statistically significant ($U=1138.5$ $Z=-0.060$ $p=0.952$). Finally, for enjoyment, the same test showed that the differences were again not statistically significant ($U=953.5$ $Z=-1.366$ $p=0.172$).

H. Unlocking the "Game Room"

Regarding the **RQ6** ("Are there any differences in learning gain, perceived usability, enjoyment, and perceived educational effectiveness related to whether they unlocked the "Game Room"?") we found out that of the total of the 105 students, 69 of them managed to unlock the "Game Room", 28 failed to unlock it, while 8 did not notice it at all. Since the normality assumption was violated, a two-tailed Mann-Whitney U test showed that no statistically significant differences were found for those who unlocked the Game Room and those who did not, as far as learning gain is concerned ($U=867$, $Z=-0.804$, $p=0.421$), educational effectiveness ($U=903$, $Z=-0.504$, $p=0.614$) and enjoyment ($U=819$, $Z=-1.177$, $p=0.239$).

V. Conclusions and Future Work

In this work, we developed a serious game that can be used in software engineering courses helping students to acquire basic interviewing skills. The story plot allows players to experience all stages of the recruitment process, from application to hiring and into the working environment. They face dilemmas and make choices during the game that could affect the hiring process and the working conditions.

The players gain rewards during the game (such as "stars", "diamonds", "emeralds", and "sapphires") that can be used to unlock the Game Room at the end of the game and to play some mini-games as a reward. Based on their score they

have the option to either replay each level (aiming to get a better score) or continue to the next level.

The game was evaluated by 105 students and the evaluation results showed that these students perceived the "Galaxy Solution" game as a useful educational tool. Students rated the game relatively high regarding its usability, enjoyment, and usefulness, using both custom survey tools and standard ones such as SUS. The learning gain using a pre-posttest tool was found to be statistically significant, and the normalized learning gain was very high. Moreover, the learning gain was found to be independent of whether the players managed to unlock the Game Room or not. This proves that "Galaxy Solutions" is a game in which the player does not need to win to learn, and all players had a significant learning gain regardless of their success.

Also, no statistically significant differences were found between the genders regarding learning gain and perceived satisfaction. This means that the game is designed in such a way that it gives everyone a similar experience, fun, and learning. The gender difference is an issue that we were concerned about since in our previous game [11] we found statistically significant gender differences. In the previous game, the players could not identify their gender but there was a predefined female avatar that represented players during gameplay. This had a side effect that the female students had statistically significantly higher knowledge gain and higher assessment scores than the male students. In the "Galaxy Solutions" game, players were able to customize their avatar as per their liking and select their preferred gender before starting the challenges. This means that when players create their in-game avatar, they can immerse themselves in the game more easily.

Future work includes enhancing the game with more levels that will follow the players during their career and allowing them to face more challenges in the working environment. Our aim is to continue the evaluation, adding a laboratory-based usability evaluation that we couldn't use during the evaluation presented in this paper due to Covid-19 restrictions. Such evaluation would allow us to focus on each player during gameplay and to identify gaming elements that could be improved. Also, using tools such as interviews would allow us to receive more detailed player's feedback for each level.

REFERENCES

[1] C. Udeozor, F. Russo Abegão and J. Glassey. "An evaluation of the relationship between perceptions and performance of students in a serious game". Journal of Educational Computing Research, vol. 60, no. 2, pp. 322-351, 2022.

[2] A. Azadegan, J. C. Riedel, and J, Baalsrud Hauge. "Serious games adoption in corporate training". In International conference on serious games development and applications. Springer, Berlin, Heidelberg, pp. 74-85, 2012.

[3] S. Nørskov, M. F. Damholdt, J. P. Ulhøi, M. B. Jensen, M. K. Mathiasen, C. M. Ess and J. Seibt."Employers' and applicants' fairness perceptions in job interviews: using a teleoperated robot as fair proxy". Technological Forecasting and Social Change, vol. 179, p. 121641.

[4] D. L. Sutil-Martín and F. J. Otamendi. "Soft Skills Training Program Based on Serious Games". Sustainability, vol.13. no. 15, p. 8582.

[5] A. Calderón, M. Ruiz and R. V. O'Connor, R. V. "A multivocal literature review on serious games for software process standards education". Computer Standards & Interfaces, vol. 57, pp. 36-48, 2018.

[6] A. Mallas, A.M. Evangelou and M Xenos. "Software Engineering Students' Perceptions for a 3D Learning Environment Regarding Anxiety". In 2022 IEEE Global Engineering Education Conference (EDUCON 2022), pp. 1074-1081.

[7] K. Zarkadoula and M. Xenos. "Evaluating Usability and Educational Effectiveness of a Serious Game for Programmers Using Alternative Interfaces and Types of Activities". In 2022 IEEE Global Engineering Education Conference (EDUCON 2022), pp. 644-651.

[8] A. Vahldick, A. J. Mendes and M. J Marcelino. "A review of games designed to improve introductory computer programming competencies". In: Proc. of the Frontiers in Education Conf. (FIE 2014). pp. 1–7.

[9] V. Malvasi, J. Gil-Quintana and E. Bocciolesi. "The projection of gamification and serious games in the learning of mathematics multi-case study of secondary schools in Italy." Mathematics, vol. 10, no. 3, p. 336, 2022.

[10] I. Damian, T. Baur, B. Lugrin, P. Gebhard, G. Mehlmann and E. André. "Games are better than books: In-situ comparison of an interactive job interview game with conventional training". In International Conference on Artificial Intelligence in Education, pp. 84-94. Springer, Cham, 2015.

[11] S.M. Evangelou, G. Stamoulakatou and M. Xenos. "A serious game for mobile phones used in a software engineering course: Usability Evaluation and educational effectiveness." In Proc. of IEEE Global Engineering Education Conference (EDUCON 2021), pp. 219-22.

[12] M. Xenos and V. Velli, "A Serious Game for Introducing Software Engineering Ethics to University Students," 21st International Conference on Interactive Collaborative Learning, pp. 263–274, 2018.

[13] F. Almeida, and J. Morais. "Strategies for developing soft skills among higher engineering courses". Journal of Education, vol. 203, pp. 103-112, 2023.

[14] J. Brooke, "SUS-A quick and dirty usability scale," Usability evaluation in industry, p. 189, 1996.

[15] B. Aaron, P. Kortum and J. Miller, "Determining what individual SUS scores mean: Adding an adjective rating scale," Journal of usability studies, vol. 4, no. 3, pp. 114–123, 2009.