

Received February 9, 2022, accepted February 24, 2022, date of publication March 8, 2022, date of current version March 18, 2022.

Digital Object Identifier 10.1109/ACCESS.2022.3157526

YoungRes: A Serious Game-Based Intervention to Increase Youngsters Resilience Against Extremist Ideologies

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This work was supported in part by the Internal Security Fund-Police Action through the YoungRes Project under Grant 823701-ISFP-2017-AG-RAD, in part by the MCIN/AEI/10.13039/501100011033 through the XAI-DisInfodemics under Grant PLEC2021-007681 and through the FightDIS under Grant PID2020-117263GB-100, and in part by the “ERDF A way of making Europe” by the “European Union” or by the “European Union NextGenerationEU/PRTR” through the Research Project CIVIC: Intelligent Characterization of the Veracity of the Information Related to COVID-19 granted by BBVA Foundation Grants for Scientific Research Teams SARS-CoV-2 and COVID-19 by the European Commission under IBERIFIER—Iberian Digital Media Research and Fact-Checking Hub under Grant 2020-EU-IA-0252. The work of David Camacho was supported by the Comunidad Autónoma de Madrid under “Convenio Plurianual with the Universidad Politécnica de Madrid in the actuation line of the Programa de Excelencia para el Profesorado Universitario.”

ABSTRACT Extremist ideologies are proliferating nowadays in both political and social levels. Considering that youngsters are in a development stage where they are still conforming their own social identity, they become especially vulnerable to these ideologies’ influence. Therefore, it becomes critical to provide them with the psychological skills to rationalize and resist those influences. Video games, which are already a technology commonly consumed by these generations, provide a way to motivate and engage youngsters. Therefore, implementing these video games in interventions to increase psychological resilience represents an opportunity to create an innovative learning approach. Following this motivation, this paper has three main objectives: adapting a traditional emotional intelligence training program to a novel serious game based intervention, called YoungRes; providing a metric to measure the student’ evolution based on in-game behavioural patterns, instead of indirect measures; and evaluating the impact of the intervention itself after its implementation. To do so, an 11 sessions intervention was applied to 36 students from two primary schools in Spain. Quantitative and qualitative data was extracted from the experience, consisting on data extracted from the player’s behaviour and a final survey. A detailed statistical analysis carried out showed two main outcomes: first, the serious game based intervention was very appreciated by the students, specially by those who frequently play video games; second, the intervention allowed to improve several emotional intelligence competences, such as active listening and controlled breathing, as well as to promote knowledge about the Islamic culture. Finally, the authors discussed about how the game could be improved for future applications in schools.

INDEX TERMS Serious games, extremism, emotional intelligence, psychological resilience, hybrid intervention.

I. INTRODUCTION

The last decade has seen a spread of extreme ideologies through several sectors of society, such as politics, religion

The associate editor coordinating the review of this manuscript and approving it for publication was Muhammad Imran Tariq¹.

or sports. The deterioration of socio-economic conditions suffered during the last decade (such as the crisis of 2008, jihadism, the migratory crisis or, recently, COVID19 pandemic) has led, as previously in history [1], to the growth of discomfort and, eventually, to the increase of polarization and extremism. One of the biggest differences with similar

periods in the past is that, nowadays, the world is more connected than ever. This circumstance, even with all its advantages, also allows these ideologies to spread faster, through the use of social platforms and media as tools to promote their beliefs and attract people to their positions.

Considering this trend, youngsters represent a relevant vulnerable group to these extremist ideologies. They have a great command of technologies [2] and are in constant interaction using social platforms (often replacing face to face social interactions, such as during the COVID pandemic). Also, especially during adolescence, their self-esteem is highly influenced by their feelings of group belongingness [3] and their search for a personal, social and political identity [4]. Considering this critical development stage, it becomes understandable that people who get radicalized frequently are less than 30 years old [4], [5].

Due to the importance that contextual, social and psychological factors have in the youngsters adoption of extremist ideologies [6], the European Union has funded several intervention programs to prevent youngsters radicalization such as RaP,¹ Champions,² WayOut,³ Bridge⁴ or ARMOUR.⁵ Most of these projects' approach focus on promoting social and personal skills, through the use of traditional methodologies such as moral dilemmas or group discussions, to improve resilience against extremism. With these initiatives, the EU aims to improve the resilience of young people through social and psychological training.

Taking into consideration the importance of generating engagement in youngsters towards these type of interventions, video games emerge as tools with great educational potential, as they represent a way to attract their attention and boost their motivation [7]. Some initiatives have been proved in previous experiences, such as the ones from the MMORPG game *CMX* [8], where a serious game was used to teach students several procedural programming concepts. Through the use of video games, youngsters can be confronted with different challenges and worldviews in an under control context (e.g., the school), including more complex threats, such as extremism [9]. Specially referring to educational video games, or serious games, literature shows that their use can increase all three components of social learning: cognitive (knowledge), normative (values and beliefs) and relational (networks and relationships) [10].

In this line, we present the YoungRes program, which aims to improve youngster resilience using serious games as an engagement tool. The contributions of this program are twofold: On the one hand, to adapt a traditional program, Fortius [11] in our case, to a serious game as a way of improving the engagement of youngsters. On the other hand, to switch the focus between self-perceived changes, like the ones obtained in traditional programs via questionnaires,

to behavioral measurements, like the ones obtained during gameplay sessions. This dichotomy has been traditionally studied from a methodological point of view [12], [13], showing that direct measures, such as the one applied in YoungRes intervention, is a more reliable way of measuring changes in the learning process. Finally, to test the effectiveness of the program, the intervention has been carried out in two Spanish schools.

The main contributions of this article are:

- The adaptation of a traditional emotional intelligence training program to a serious game based intervention.
- The use of behavioural measurements, obtained during gameplay, instead of self-perceived changes, obtained by attitude questionnaires.
- The evaluation of the outcomes of the YoungRes intervention, both from a behavioural and an attitudinal perspective.

The article is organized as follows: Section II presents the concept of emotional intelligence, its relationship with resilience, and how games can be used to improve it. Section III introduces the psychological foundations of the intervention. Section IV explains how YoungRes specifically deals with this problem, showing how emotional intelligence components are approached and measured. Section V summarizes the methodological conditions to apply the intervention in two schools. Section VI presents a summary of the outcomes obtained, divided in two sections: a first one dealing with the behavioural changes in the youngsters (using data obtained during the gameplay sessions), and a second dealing with their attitude towards the intervention (through the use of a questionnaire applied after it). Finally, in Section VII, the authors justify their outcomes, comparing them with previous findings from the literature, and debate future lines of research.

II. STATE OF THE ART

A. EMOTIONAL INTELLIGENCE AND RESILIENCE

Resilience is defined as “*the ability of an individual person or a social system to grow and develop in difficult circumstances*” [14]. It refers to a person's aptitude to adaptively deal with challenging and problematic situations, acting like a counterpart of the concept of “psychological risk factors” [15]. Resilience has grown interest in the scientific community recently (especially in the context of extremism prevention), as being able to confront difficult situations is a critical psychological key to have an appropriate development in the society at all levels (schools, home, work, social interaction, etc.) [16].

Following the literature, most of the authors agree that emotional and social competencies are critical elements to develop resilience against extremist ideologies [17], [18]. Feddes et al. [19] concluded that an intervention aimed to empower individuals and strengthening empathy was successful to prevent the adoption of these ideologies. This outcome goes in line with the psychological skills found to be

¹<https://rap.education/en/>

²<https://www.championsproject.eu/>

³<https://wayout-prison.eu/>

⁴<https://efus.eu/en/topics/activity/16652/>

⁵<https://armourproject.eu/>

protective against radicalization processes at individual level (as opposed to group or society levels), such as self-control or positive attitudes towards law and police, and a positive peer group influence [20]. These psychological variables are comprised inside a bigger one: the correct development of the youngster's emotional intelligence. Emotional intelligence is understood in psychology literature as *"the ability to perceive accurately, appraise, and express emotion; the ability to access and/or generate feelings when they facilitate thought; the ability to understand emotion and emotional knowledge; and the ability to regulate emotions to promote emotional and intellectual growth"* [21]. Emotional intelligence can be divided in four related components [22]:

- The ability to perceive self and others emotions.
- The ability to use emotions as a way to focus the thoughts.
- The ability to understand emotions.
- The ability to regulate and manage emotional states.

Improving these components of emotional intelligence is critical to improve people's resilience against any psychological crisis. A correctly developed emotional intelligence represents a resilience factor against different life problems, including addictions [23], depression [24], bullying [25] or even suicidal behavior [26]. Training emotional intelligence also acts as a protective factor against radicalization processes [19]. Considering that training youngsters emotional intelligence to improve their resilience against extremism can be a difficult task, the mechanisms to engage them to intervention programs shall be motivational enough to attract them. This is, precisely, where games represent an interesting tool to address this problem.

B. SERIOUS GAMES TO IMPROVE RESILIENCE SKILLS

Information and communication technologies (ICTs), such as video games, social platforms or online market platforms are producing deep transformations in society in different levels, including technological, economic and social. These changes have influenced the way in which people receive and assimilate information. In the context of education, the immediacy in the transmission of content, as well as the presence of content in multiple audiovisual formats, means that educators must adapt their methodologies to the new demands of society, but also to the new characteristics and interests of their students. In this sense, in the last decade, a change has been experienced regarding the use of traditional methodologies and, currently, the use of ICTs in education has been widely disseminated. Especially during COVID-19 pandemic, educators had to step forward to a new way of teaching, including interactive platforms (e.g. Moodle), streaming platforms (e.g. YouTube) or communication services (e.g. Zoom, Microsoft Teams or Skype).

Games have also taken part of this adaptative process. The gamification of education and the use of resources such as Virtual Worlds (VM), regular or educational video games [16], [27]–[33] have shown enormous potential as educa-

tional tools, which can be successfully applied to improve the educational experience for students and teachers [34], [35]. While each type of game has a different application approach and certain guidelines should be considered depending on the specific case [36], literature has shown that all of them can have an impact in the learning process. Indeed, recent studies like [31] and [33] have proven that in certain scenarios serious video games are at least as or even more effective from a motivational and knowledge acquisition perspective than other learning approaches such as master classes or video-based learning. Table 1 presents some comparative information about the definition, applications and literature examples of games, video games, serious games and gamification.

In contrast to regular video games, which are created with the main purpose of entertainment and can (eventually) be used as complement in educational contexts, serious games main purpose are to teach and educate the players directly. This type of video games are used in different disciplines (such as medical, military, or ethical issues) [46] with one objective: to transform the educational experience in a more motivating process, avoiding traditional ways of transmitting information and using alternative channels so that students can feel more interest and engagement with that process. In the specific field of resilience improvement, they are useful to train and solve real-life problems through the training of emotional intelligence skills. Some studies in the field of serious games reported that people who faced the challenges presented in the games improved their confidence to deal with the challenges in their real life [16], [47]–[49].

Virtual simulations or decision-making games are the most used type of serious game in the context of psychological interventions [16]. Their main advantage is that they allow to recreate real life-situations or problems in which the players can make decisions and face the consequences of their choices, both for their avatar and story's course. To make these decisions, players must put into practice skills related to emotional intelligence, including empathy, active listening, conflict resolution and decision making. In fact, as other video games, serious games are designed to provoke certain emotions in players [50] but also to train the ethical thinking procedure [51].

Serious games, such as those presented below, have shown positive results when applied to the training of different psychological skills associated with emotional intelligence and resilience. For example, in the field of education, a serious game called Shimpai Muyou! [52] was created to deal with an Islamic bullying in the schools. During the gameplay, students have to put into practice psychological skills such as empathy, active listening or emotional recognition. Other serious games, like Related SPARX [53], Mindlight [54] and Dojo [55] were created with the objective of teaching youngsters how to control anxiety, including skills such as breathing for relaxation. Regarding social skills, the serious game Reach Out Central [56] is a role-playing game that allow players to put into practice their skills to make friends in a new town for the main characters, while they can see

TABLE 1. Differences between games, video games, serious games and gamification, and their educational potential.

	Game	Video game	Serious game	Gamification
Definition	Free activity that is generally carried out according to rules, in an orderly manner, within certain spatio-temporal limits [37]	Type of game that uses an electronic device such as a mobile phone, computer or game console, created with entertainment purposes [38]	Type of video game created with educational purposes [39], [40]	Use of game design elements in non-game contexts such as rankings, awards, level, etc. [41]
Literature examples in education	Board games used in schools [42]	Age of Empires as a tool to teach History [43]	Serious games in schools [44]	Gamification to teach values in sports [45]

the variation of their mood depending on their actions. In the review elaborated by Pusey *et al.* [16] more initiatives to promote resilience by using interactive technology can be found.

Considering the outcomes obtained from the application of serious games to improve emotional intelligence, the objective of this article is to apply this educational tool as an intervention to reduce risk of polarization in youngsters. To do so, a traditional intervention will be adapted to include serious games, with the objective of increasing the youngsters interest and engagement with the educational experience. Besides, the serious game itself will extract data from the in-game player’s behaviour, which will allow to analyze directly the evolution of target psychological skills, instead of focusing on only relying on self-reported data using questionnaires.

III. PSYCHOLOGICAL FOUNDATIONS OF THE INTERVENTION

The psychological skills approached by this intervention were the same than those from an already existing school based intervention program: Fortius [11]. Fortius intervention’ main goal was to improve psychological resilience to prevent emotional difficulties in the school, through the use of both theoretical content and activities that were adapted for the purposes of creating YoungRes’ hybrid approach. The emotional intelligence skills adapted from Fortius were:

- **Emotional recognition:** as stated before [22], the ability to perceive and understand emotions is critical for a correct emotional intelligence development. Therefore, teaching the kids how to identify emotions, both from explicit (such as facial expression) or implicit clues (for example, a conversation) represents a way of improving this ability. Fortius program uses the concept of the “pyramid of personality” [11] to teach students about the interconnections between three pillars of psychological responses: thoughts, emotion and behaviour.
- **Relaxation:** underlying this psychological recovery concept, Fortius proposes three different approaches: breathing control, progressive muscular relaxation and visualization. All of them try to teach children different (and complementary) ways of self-control during an arousing situation, but using different approaches: breathing deals with the systematic and conscious con-

trol of breath; progressive muscular relaxation deals with the relation of muscles following an specific pattern to redirect the person’ focus; finally, visualization helps the person momentarily evading an arousing situation, asking the student to mentally focus on a pleasant scenario. Due to the difficulties of measuring these skills, only breathing was included as a measurable variable in YoungRes intervention (however, notions of progressive relaxation and visualization were taught to the students during the intervention).

- **Active listening:** this technique, opposed to the concept of “passive” listening, implies a deeper approach to active interactions with another speaker. Essentially, active listening involves an empathetic approach to the speaker, the conscious intention of understanding what the other is trying to say, and to make the other feel listened and part of the interaction [57].
- **Interpersonal styles recognition:** this technique deals with the identification of different social styles, based on behavioural and emotional interactions. Identifying the different interpersonal styles proposed by Fortius (assertive, shy and aggressive) allow students to lately to deal with every kind of social profile, including their emotions, behavior and thoughts.
- **Social skills:** the correct development of social interactions is a key factor for every person. In the case of Fortius (and YoungRes), the students are taught to learn to use them (e.g., greeting someone, asking things politely, or how to deal with critics) and how the different interpersonal styles can be identified through their use of social skills.
- **Self-instructions:** this technique deals with the self-regulation of thoughts, with the aim of teaching the student how to avoid ideas that can generate negative emotions.

Through the training of these skills, the four components of emotional intelligence (perception, use, understanding and regulation of emotions) are trained. Figure 1 summarizes how these components and skills are related during the training. Finally, and considering that the objective of the present intervention is to reduce risk of polarization, it was decided to mix the training of emotional intelligence with the teaching of other cultures to students; in this case, Islam. Therefore,

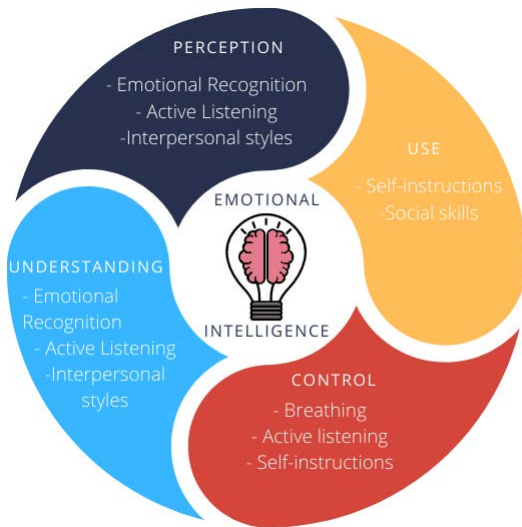


FIGURE 1. Distribution of emotional intelligence skills to train emotional intelligence components.

TABLE 2. Sessions that compose the YoungRes intervention and the topic covered in each one of them.

Session	Topic
Nº1	Triangle of Behaviour
Nº2	Empathy
Nº3	Breathing
Nº4	Relaxation
Nº5	Visualization
Nº6	Active listening
Nº7	Social skills
Nº8	Islamic culture
Nº9	Interpersonal styles
Nº10	Self-instructions
Nº11	Problem management and solving (practice of all the previous psychological skills)

the story background of the serious game was design to pivot around an inclusive approach to this culture.

IV. YoungRes PROPOSAL

YoungRes intervention was built over the psychological foundations previously stated from Fortius, changing the face-to-face approach by a serious game one. This intervention is aimed to youngsters between 10 and 14 years old and is composed of 11 sessions, each one with an estimated duration of 1 hour. During these sessions, the psychological skills presented in the previous section and content related to other cultures relevant to improving resilience is addressed. The topic to be covered in each session can be found at Table 2.

During each session, students will play two chapters of the video game. In addition, between chapters, they will receive a master class in which the teacher will explain the underlying psychological skills, watch videos and perform other complementary exercises. Finally, the teacher can use the visualization tool to monitor the performance of the whole class or particular students. A summary of a standard session is available below:

- 1) **Chapter 1:** Students play the first chapter of the session, which presents the problems addressed during the session and enables the extraction of data prior to the intervention.
- 2) **Masterclass:** Students watch a video (or the explanation of the educator in charge), where the psychological skill underlying the session is explained. Complementary exercises are proposed to practice that technique.
- 3) **Chapter 2:** Students play the second chapter of the session, where they have to apply what they have learned during the masterclass, and the post-intervention data is obtained.
- 4) **[Optional] Teacher monitoring:** Once the activities above have finished, the teacher uses the visualization tool to monitor the class performance or the performance of a particular student.

A. YoungRes SERIOUS GAME

In the YoungRes serious game, the players must get themselves under the skin of a character who is having problems with a Muslim boy bullied at school. Throughout the video game, the main character is confronted with different situations in which he/she have to put into practice different psychological skills, such as emotional recognition, active listening or social skills, among others.

The serious game was designed as an “Interactive Drama”. This genre features narrative-heavy games in which the player makes decisions and experiences the consequences of those decisions as the story unfolds (the video game *Life is Strange* is an example of this game genre, as seen in [58]). The Interactive Drama genre is perfect for the intervention because it has a gentle learning curve and the play sessions can be easily delimited. For example, you can’t die, lose or get stuck in the YoungRes video game, whatever choice you make the story always moves forward. In addition, being narrative-heavy allows the designer to focus on storytelling and character building, which is perfect for introducing content related to other cultures. Finally, the main mechanic in this genre is making decisions, for which which it is ideal for posing moral dilemmas and facilitate the task of extracting behavioural data.

In the typical game loop of the YoungRes video game you control a child in everyday activities, for example playing with his/her classmates during break time. Your avatar can move around and talk with other Non-Playable Characters (NPC). At some point, an event is triggered that forces the student to make a decision (a recorded gameplay is available on Youtube⁶) These events were designed by the researchers following exercises presented as regular activities that were part of Fortius. The events could take two different forms:

- 1) A dilemma presented for the player, which was related with the theoretical concept studied in each session.

⁶<https://www.youtube.com/watch?v=1C4UEhwZxGA>

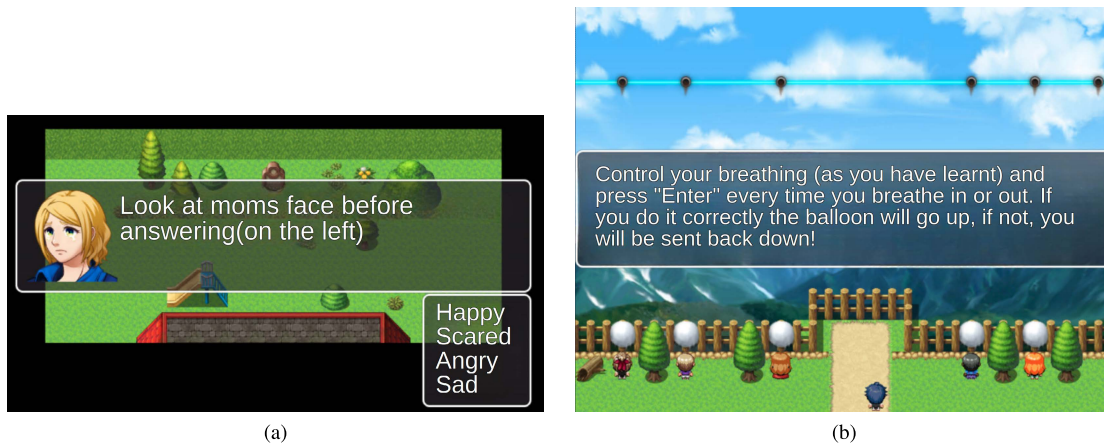


FIGURE 2. Video game screenshots: Subfigure (a) contains an example of decision-making about feelings of the main character’s mother (emotional recognition). Subfigure (b) contains an example of a mini game in which the players have to control their breathing. The caption of the screenshots have been translated to english for this paper.

- 2) Some mini-games to spice up the gameplay and test other skills. For example, a rhythm mini-game where the player’s breathing technique is tested.

The actions of the players during these events are crucial to the intervention, as they will be used as behavioral measures. For example, to measure the capacity of a student to identify emotions, an event can ask the player how an NPC is feeling based on the character’s facial expression or actions, following Ekman’s theory of the Basic Emotions [59] (see Figure 2 (a)). Or to test if a student have learned to breath correctly, an event can trigger a movement-based mini-game. During this mini-game, the player had to control a balloon by clicking the “enter” key as they breath in and out. When the button is pressed following a correct breathing rhythm, the balloon goes up. Contrary, if the time was not respected (i.e., if the time to complete a full deep breathing process was not respected), the balloon goes down (see Figure 2 (b)). A summary of all the events included in the game, their general description and the categories they belong to are available at Table 3. This table shows the events grouped into the psychological skills presented on Section III. Notice that this grouping has been done following the indications from a psychologist and an educator.

B. EXPLANATORY VIDEOS AND COMPLEMENTARY ACTIVITIES

Originally, Fortius program explained the content of each session of intervention since the beginning of the session itself; this means, the explanation of the theoretical contents was integrated during the whole session. While this makes sense in an intervention which is measured only in the beginning and in the end (using questionnaires), the objective of using behavioural measures made this impossible for the YoungRes approach. Therefore, it was decided to alternate the theoretical concepts with the different chapters of the serious game. This structure allowed to present the problem, then

to introduce the psychological skills to solve it and, finally, to apply those skills.

The presentation of the theoretical content was originally planned to be face-to-face and conducted by the educator in charge of the group. However, the limitations derived from COVID led the team to facilitate as much as possible the intervention’s application. Therefore, the theoretical content was recorded in videos by the research team, which eventually were included in a Moodle platform together with the rest of the intervention, so the educators had direct access to the content with no need of a previous background in psychology. However, it was decided to include also the slides used during the explanatory video, in case any educator would be interested on explaining the content by his/her own.

Together with the explanatory videos, different activities (exercises) were included in the Moodle Platform. These exercises include filling the gaps with the correct words, answering short questions, relating concepts or identifying images of people, using the content explained during the intervention. The motivation to include these exercises was to give the educators the chance of including more content to ensure that the students understood the concepts approached during the session. Therefore, these exercises were included as a complement, an never as a substitute of the videos and the serious game chapters.

C. VISUALIZATION TOOL

The educators also had access to a visualization tool, which displayed the different decisions made by the students during the intervention, previously stored in a database. This visualization tool allowed the teachers to monitor each sessions of the intervention by screening both the decision made by the whole class during a chapter, but also to check specific children’s performance (with a filter made with the usernames, only known by each group’ educator).

TABLE 3. Description of the events and categories measured inside the game.

Category	Event	Description	N° events
Emotional recognition	Behavioural triangle.	Questions about other character feelings, considering the behaviour.	4
	Face recognition.	Questions about other character feelings, considering its facial expression.	2
Active listening	Attention during conversations.	Questions to check if the player is focused on the conversation.	2
	Identification of active listening.	Questions to check if the player understands the difference between active and non-active listening	2
	Identification of conversation limits.	Questions to check if the player knows when to maintain and when to stop a conversation.	2
Interpersonal styles	Identification of social styles.	Questions about the social style held by a character inside the game (assertive, shy or angry).	6
Social Skills	Social skills for each interpersonal style.	Questions to check if the player identifies how each interpersonal style uses social skills in a way or another. For example, going through the same situations acting as two different actors: one aggressive and one shy.	8
Self-instructions	Knowledge about cognitive self-regulation	Questions regarding different problematic situations, to check if the player identifies assertive thoughts.	6
Islamic culture	General information about Islamic culture.	Questions regarding general knowledge about the Islamic culture.	6
Breathing	Breathing trials.	Short rhythm mini-game to test breathing skills.	2



FIGURE 3. Screenshot of the visualization tool. The image shows all the decision taken by a whole class during a particular chapter. Each bar represents an event and the colors in the bar the number of students that have chosen a particular option.

An example of the visualization tool interface (displaying the analysis of an event and the answers from the students to it) is presented in Figure 3.

D. IT ARCHITECTURE

To manage the interventions, an entire IT architecture has been implemented, which is shown in Figure 4. This IT

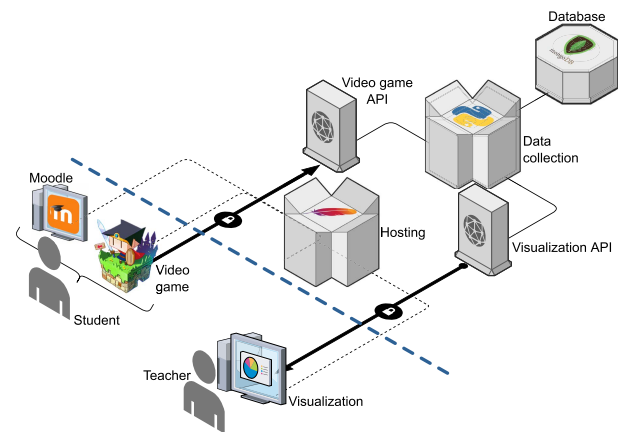


FIGURE 4. Software architecture of the system designed for YoungRes intervention. This figure shows the different components of the system, the different users that will work with the system and the different subsystems that these users will interact with.

architecture is composed of: i) A MongoDB⁷ database to store all information extracted during gameplay ii) A Python Flask⁸ server that provides APIs that manage communications between the video game and the visualization tool

⁷<https://www.mongodb.com/es>

⁸<https://flask.palletsprojects.com/en/2.0.x/>

with the database. iii) An Apache⁹ server where everything is hosted. iv) A Moodle¹⁰ platform to act as hub for the intervention. v) A browse version of the serious game. vi) A browser version of the visualization tool.

We have opted for a Moodle platform to act as a hub for the whole intervention. We have decided to use Moodle because is one of the most popular e-learning platforms and schools have usually worked with it. From the Moodle platform, both students and teachers can easily access all the content planned for a session. The video game was developed using RPG Maker.¹¹ Although there exists more sophisticated software (such as Unity 3D¹²) to create video games, RPG Maker has several advantages. First, little programming skills are required to use the tool, which allows researchers from areas outside IT to participate actively in the game development. Second, RPGMaker already contains all the mechanics needed for our videogame genre. Third, the application is customizable thanks to its plug-in system. Finally, RPGMaker can export a game in different formats like a web, mobile, or desktop application. Regarding the visualization tool, it was developed as a single-page Vue.js application capable of running on modern browsers and smartphones.

All the web applications above (Moodle, Videogame, and Visualization tool) are hosted on an Apache server. In addition, several plugins were developed to allow communication between RPGMaker and the database to store players' activity. Finally, two different REST APIs were developed to connect the video game plugins to the database and the database to the visualization tool. These APIs are hosted on a Python flask server and provide secure and encrypted communication channels that enable sensitive user data to be accessed only by the appropriate people.

V. METHODOLOGY

To to check the usefulness of the YoungRes intervention, a descriptive, longitudinal and prospective analysis was conducted. The aim was to measure the evolution of different emotional intelligence components from the same sample which was trained with the intervention (descriptive), showing how those components improved from an starting point (prospective) and measuring the evolution of those variables during the whole program (longitudinal).

A. PARTICIPANTS

The whole intervention was originally applied to 36 children from two different schools. These children were included in the experiment using an opportunity sampling, thanks to different contacts of the researchers with the schools. The names of the schools are not given in order to maintain anonymity, but each school and relevant information about the sample is described below.

⁹<https://httpd.apache.org/>

¹⁰<https://moodle.org/>

¹¹<https://www.rpgmakerweb.com/>

¹²<https://unity.com/>

TABLE 4. Sample description.

	N	Boys/Girls	Students playing video games with a medium to high frequency
School 1	15	5/10	15 (100%)
School 2	21	0/21	9 (43%)
Total	36	5/31	24 (67%)

The first school (hereinafter School1) was a rural school from Cordoba (Andalucia, Spain), which is characterized by having a low number of students per classroom, with different ages. Specifically, the group in which the intervention took place had 15 students between 10 and 13 years of age and consisted of 5 boys and 10 girls. By surveying the sample, we found that all the students played video games with a medium to high frequency.

The second school (hereinafter School2) was a school for girls from Sevilla (Andalucia, Spain). Specifically, the group in which the intervention took place had 21 students between 13 and 14 years of age, all girls. In this case, it was found that 9 out of 21 students (43%) played video games with a medium to high frequency, a percentage significantly lower than the one from the first school. Table 4 summarizes this information and presents the aggregated information from both schools.

B. PROCEDURE

After the confirmation of the Ethical Panel of Universidad Politécnica de Madrid to apply the intervention, different schools were contacted through email invitations to be part of the intervention. Due to the limitations both from COVID and time, and the need to apply the complete intervention (11 1-hour sessions in 11 days), only two schools answered positively. After that, the designers of the intervention had multiples meetings with the teachers in charge of implementing the intervention, sending both a link to the video game and to the online platform where explanatory videos, exercises and the game itself were included. This decision was made to give teachers time to familiarize with the content while checking the characteristics of the intervention, but also to check the technological requirements to apply the intervention in the school.

The researchers kept contact with the teachers during the whole intervention, as a way to answer questions, give technological and educational support and to provide feedback in case that any intern bug was found in the game. The interventions lasted 4 months each one, including the 11 sessions and the previous training meeting with the teachers.

C. INSTRUMENTS

Beyond the YoungRes program (Section IV), a User Experience questionnaire that measures the children's interest in the program was also applied at the end of the interventions. This questionnaire is independent of the YoungRes program and was created with the objective of gathering feedback about

TABLE 5. Frequency distribution of students ratio of successes.

Variable	N	Successful answers	Global		School 1		School 2	
			N pre	N post	N pre	N post	N pre	N post
Emotional recognition	30	3	19	19	8	5	11	14
		2	11	8	3	4	8	4
		1	0	3	0	2	0	1
		0	0	0	0	0	0	0
Active listening	32	3	15	18	3	6	12	12
		2	11	3	5	4	6	9
		1	5	1	3	1	2	0
		0	1	0	0	0	1	0
Interpersonal styles	34	3	7	10	3	4	4	6
		2	14	10	3	3	11	7
		1	12	12	5	5	7	7
		0	1	2	1	0	0	2
Social skills	23	4	11	14	3	4	8	10
		3	4	4	2	3	2	1
		2	3	0	2	0	1	0
		1	4	4	1	2	3	2
		0	1	1	1	0	0	1
Self instructions	31	3	21	14	6	4	15	10
		2	9	12	4	3	5	9
		1	1	4	1	3	0	1
		0	0	1	0	1	0	0
Islamic culture	32	3	18	24	4	7	14	17
		2	9	7	2	4	7	3
		1	4	0	4	0	0	0
		0	1	1	1	0	0	1

it strengths and weaknesses. The questionnaire consists of 16 questions and was filled by the student at the end of the intervention. Three sociodemographic questions were related to the age, the gender and the frequency of use of video games. Eleven questions were built as Likert scales, from 1 (low agreement) to 5 (high agreement), and ask for feedback about the video game and complementary activities. Finally, two open answer questions were created, asking the students about their most/less favourite thing about the video game, and if they had learn something important while playing it.

D. DATA ANALYSIS

To calculate the scores for each of the psychological skills covered by the video game, a binary approach was considered. Each event (except for the mini-game ones) had one or two correct answers, depending on the dilemma. The percentage of correct answers was calculated for all of the events and for all the students. After that, the mean of the successes in all the events related to one category by student was calculated, dividing each category in pre and post scores.

The case of the breathing variable was slightly different. The player had to conduct a mini-game based on the breathing times he/she learnt. Therefore, each time the inhalation/exhalation was completed, the player had to click the “enter” key, and his/her avatar moved a step forward. If the time was not respected (i.e., if the time to complete a full deep breathing process was not respected), the avatar moved a step backwards, and the score was increased in 1. After com-

pleting the exercise, the final score of each student showed the total amount of mistakes committed during the process. Therefore, a score of 0 meant a perfect exercise, and a score of 10 meant 10 mistakes completed before completing the exercise.

After confirming an absence of normality in the distribution of the variables, a non-parametric comparison was chosen. In this case, pre and post scores were compared through the use of a Wilcoxon’s rank test. This test was used to compare the pre and post scores for the whole sample, as well as for each school. In addition, the pre and post scores and the learning evolution of both schools were compared with each other by using the Mann-Whitney test, which is the non-parametric test used to compare independent samples. Same happened with the responses provided through the questionnaire by the students; as they did not follow a normal distribution, the Mann-Whitney test was also used to compare the responses of the students from both schools.

VI. OUTCOMES

A. IMPACT OF THE INTERVENTION

The first step was a preliminary exploratory analysis of the frequency distribution of the students’ scores. The summary of the answers can be seen on Table 5. It shall be highlighted that some students were absent during parts of the intervention due to illness or other events of force majeure. Hence, only data for the children completing all the events were included

TABLE 6. Global learning impact of the intervention (* = p < 0.05, ** = p < 0.01).

Variable	Pre M(SD)	Post M(SD)	Learning Gain
Emotional identification	0.88 (0.16)	0.84 (0.22)	-0.04
Active listening ▲	0.75 (0.28)	0.84 (0.19)	0.09*
Interpersonal styles	0.59 (0.27)	0.60 (0.31)	0.01
Social skills	0.71 (0.32)	0.78 (0.32)	0.07
Self-instructions ▼	0.88 (0.18)	0.75 (0.27)	-0.13*
Islamic culture ▲	0.79 (0.27)	0.90 (0.21)	0.11*
Breathing ▲	0.86 (0.60)	0.48 (0.47)	-0.38**

in the summary. The “breathing” variable is not present in the table, due to its continuous nature.

The second step was a course-grain analysis that checked for significant improvements in the variables during the intervention for all the participating schools. Table 6 presents the Mean (M) and Standard Deviation (SD) per variable for the pre and post scores, as well as the resulting learning gain (difference between pre and post scores). The only variable in this table which shall be interpreted differently is breathing, as the mean does not indicate the percentage of accuracy, but the number of fails in the task (therefore, a higher score means a poorer performance, with more failures). Statistically significant differences between the pre and post scores were calculated using the Wilcoxon’s rank test. This step allows to assess whether the student has improved (▲), worsened (▼) or remained the same. The differences are indicated in the learning gain through asterisks (* = p < 0.05, ** = p < 0.01).

As can be observed from the aforementioned table, the changes in the variables analyzed can be divided into three categories:

- Non-significant changes: emotional identification, interpersonal styles and social skills.
- Significant improvement: active listening, islamic culture and breathing. It shall be stated that a “decrease” in the breathing tasks implies a decrease in the number of failures, and therefore an “improvement” in the task.
- Significant decrease: self instructions.

The third and final step was a fine-grain analysis that check for significant improvements in the variables during the intervention for each of the participating schools independently. Table 7 presents the Mean (M) and Standard Deviation (SD) of each variable for the pre and post scores as well as the resulting learning gain for each school. Statistically significant differences between the pre and post scores were calculated using the Wilcoxon’s rank test. The results are indicated in the learning gain column through asterisks (* = p < 0.05, ** = p < 0.01). Furthermore, this step includes an analysis that looked for differences between both schools (see Table 7, column *School1 VS School2*). In this case, the statistically significant differences between both schools were calculated using the Mann-Whitney’s rank test. The resulting differences between schools for each variable

is depicted on the aforementioned column and the superior school is marked with a (*S¹*) if it is School1 or a (*S²*) otherwise. Once again, the degree of significance is indicated through asterisks.

B. USER EXPERIENCE OF THE INTERVENTION

Concerning the perception of the students towards the intervention, Table 8 presents the results of the user Experience questionnaire. The items are depicted by sections, one to assess the video game, another to assess the complementary activities and, finally, one to check the students’ self-perception about the impact of the YoungRes program. For each item, the Mean (M) and Standard Deviation (SD) are depicted. Moreover, the column *Total* shows the aggregate results for the whole sample, while columns *School1* and *School2* show the results for the children in those schools, respectively. Finally, the Mann-Whitney test was carried out to check for statistical differences between School1 and School2. As usual, significance is indicated through asterisks.

Overall, the results are quite positive since all the items are above 4 (out of 5). In addition, the educational experience was better valued by the students of the School1 and there are many significant differences between the responses provided by the students of both schools.

Finally, regarding the open questions asked to the students about the experience, many of them are positive and refer to student learning; for example, “*I have learned about emotions and how to listen and solve problems without violence*”, “*I have realized the importance of respect others and treat them well regardless of their culture or race*” or “*I have benefited from the relaxation skills*”. In contrast, other comments indicate aspects perceived negatively by some students, such as “*some mini-games within the game were complicated and I got stuck*” or “*sometimes the game felt long and boring*”. It should be noted that the students who indicated comments like these also indicated that they do not frequently play video games.

VII. DISCUSSION

The discussion of the outcomes can be divided into two different subsections based on the object of evaluation: the ones obtained from the player’s behavior during the game session and the ones obtained from the questionnaire. The former followed a quantitative approach and focused on the changes in the psychological resilience of the students. The latter followed a mixed approach and focused on the student’s perspective about the intervention itself.

A. BEHAVIOURAL OUTCOMES

The analysis carried out with the data extracted during gameplay showed that the learning experience was useful to develop certain target variables, specifically active listening, Islamic culture and breathing. Other variables did improved, but not significantly, and one variable (self-instructions) worsened, thus making it necessary to redesign certain contents of the learning experience.

TABLE 7. Learning impact per school (* = p < 0.05, ** = p < 0.01).

Variable	School1 M(SD)			School2 M(SD)			School1 VS School2 difference		
	Pre	Post	Gain	Pre	Post	Gain	Pre	Post	Gain
Emotional identification	0.91 (0.15)	0.76 (0.25)	-0.15	0.86 (0.16)	0.89 (0.19)	0.03	0.05	0.13	0.18
Active listening	0.67 (0.25)	0.82 (0.22)	0.15* ▲	0.79 (0.28)	0.86 (0.16)	0.07	<i>S</i> ² 0.12**	0.04	0.08
Interpersonal styles	0.56 (0.32)	0.64 (0.28)	0.08	0.62 (0.23)	0.59 (0.32)	-0.03	0.06	0.05	0.11
Social skills	0.64 (0.34)	0.75 (0.29)	0.11	0.77 (0.31)	0.80 (0.34)	0.03	0.13	0.05	0.08
Self-instructions	0.82 (0.22)	0.64 (0.33)	-0.18	0.92 (0.14)	0.82 (0.20)	-0.10* ▼	<i>S</i> ² 0.10**	0.18	0.08
Islamic culture	0.61 (0.34)	0.88 (0.16)	0.17* ▲	0.89 (0.16)	0.90 (0.23)	0.01	<i>S</i> ² 0.28*	<i>S</i> ² 0.02*	<i>S</i> ¹ 0.16*
Breathing	0.58 (0.73)	0.32 (0.23)	-0.26	1.00 (0.47)	0.57 (0.54)	-0.43** ▲	<i>S</i> ¹ 0.42*	0.25	0.17

TABLE 8. Questionnaire results (* = p < 0.05, ** = p < 0.01).

Section / Item	Total M(SD)	School1 M(SD)	School2 M(SD)
Overall perception of the video game			
I like the video game **	4.14 (0.92)	4.80 (0.40)	3.67 (0.89)
I found the video game easy to use	4.08 (0.95)	4.27 (0.68)	3.95 (1.09)
I found the video game fun **	4.08 (0.95)	4.80 (0.40)	3.57 (0.90)
Overall perception of the complementary activities			
I liked the complementary activities **	4.08 (0.86)	4.61 (0.61)	3.71 (0.82)
Perception of the learning impact of the experience			
I have learned about emotions **	4.67 (0.47)	4.93 (0.25)	4.48 (0.50)
I have learned relaxation skills *	4.53 (0.60)	4.80 (0.40)	4.33 (0.64)
I have learned to listen actively **	4.56 (0.68)	4.93 (0.25)	4.29 (0.76)
I have learned about Islamic culture *	4.25 (0.86)	4.67 (0.47)	3.95 (0.95)
I have learned to treat others kindly	4.67 (0.53)	4.80 (0.54)	4.57 (0.49)
I have learned to better understand other people behavior	4.69 (0.46)	4.87 (0.34)	4.57 (0.49)
I have learned to solve conflicts *	4.44 (0.60)	4.60 (0.49)	4.33 (0.64)

Regarding emotional identification, the data shows that, in general, all students were capable of identifying emotions correctly. Notice that the corresponding item in Table 6 contains pre and post scores of 0.88 and 0.84 respectively. However, when the two schools were analyzed independently, School1 showed a significant decrease between pre and post measurements compared to School2 (see Table 7). After identifying the questions where students had more failures and discussing them with the educators, it was detected that the students found difficult to clearly discriminate between some of the face expressions. For example, they found easy to discriminate between happiness and other emotions, but found more difficult to discriminate anger and sadness based on the facial expressions. Previous studies have shown that longer interventions focusing on identification of non-verbal expressions (such as facial expressions) do have a significant impact on youngsters ability [60], including interventions based on new technologies [61]. Therefore, one of the possible ways of improving the intervention is to include more events related with facial expression identification, and also to add some reminders for children with cues about this psychological skill (as they are not taught again about facial expression since day 1-2 of the intervention).

Active listening does present an improvement (significant for the general comparison and for School1). This psychological skill, deeply related with empathy and emotional intelligence, helps the person developing a correct understanding

of others emotions. During the game, the students ability to listen actively is measured through three type of events: asking them about information presented during different conversations (sometimes, having to recall from previous sessions), asking them to identify when an active listening situation is taking place and, eventually, when a conversation shall be continued or the actor interacting with them feels uncomfortable. Considering the schools separately, both of them improved in active listening, however only School1 improved significantly. Considering that School1 had a worst baseline in this skill compared to School2, and that both schools final score is relatively similar (more than 0.8), it can be concluded that the intervention was helpful to improve their active listening skill.

Regarding the identification of interpersonal styles, there was no significant change in the scoring before and after the intervention. When analyzing the behaviour of the children during the game events, it was found that the mistakes were concentrated in the difference between “assertive” and “shy” styles. While this means that children may be able to correctly identify aggressive behaviours when they see it, which is critical for the identification, for examples, of bullies in the school [62], identifying correctly between assertive and shy individuals may be helpful to understand people who tend to be submissive to those who are not. Therefore, this is where a future version of the intervention should improve: focusing on each of the three interpersonal styles

separately, emphasizing the characteristics of each style and the differences with the others (and not only presenting those characteristics during the videos).

Deeply related to interpersonal styles appears the social skills related with each of those styles. As stated on the literature, while training social skills alone has little impact on behaviour and psychopathology, training it together with other skills (such as active listening) may have a deeper impact on different type of disorders [63], which eventually would represent an improvement on resilience. While there is a general improvement for both schools on this skill, the difference was not significant.

In the line of the outcomes obtained in the interpersonal style events, it was found that students identified better the social answers that an aggressive person would transmit than those transmitted by a shy person. This means that identifying both the typical behaviour and the characteristics of a shy person is difficult for them, and therefore this interpersonal style and its related skills should be approached deeply by the intervention in the future.

Self-instructions imply the use of cognitive restructuring to change the direction of certain thoughts that children may have, avoiding aggressive or negative thinking and supporting assertive ways of dealing with situations. In previous studies [64], [65], teaching cognitive restructuring skills was found useful to reduce stress, fear and anxiety among students confronting anxiogenic activities. However, as it was derived from the outcomes of this intervention, the students score in this variable did not improve, but decreased significantly. After discussing with the educators about the possible origin of the decreasing after the intervention, it was considered that the instructions given to them during the intervention were confusing, or too difficult to understand. The content regarding self-instructions is difficult to learn, and probably only one session is too short for them to acquire all the knowledge to apply it positively, especially compared with other interventions regarding cognitive restructuring [64]. Future iterations of the intervention should, therefore, consider including more educational information about self-instructions, probably in two or more sessions, instead of one. Otherwise, it should be considered to erase the training of this skill from the video game, so the children do not get confused about it.

Precisely, some of the interventions regarding cognitive restructuring to overcome anxiety also included relaxation skills, such as breathing [64]. In fact, this is one of the variables of the intervention that showed a significant improvement, reducing the mean failures of each student and, therefore, confirming that the intervention was successful on teaching them this relaxation technique. This improvement have been seen in previous experiences with video games teaching the correct deep breathing technique, such as in the game *Chill Out* [66]. Therefore, it can be confirmed that the intervention effectively increased the students skill to control their breathing, teaching them the steps to conduct this relaxation technique.

Concerning the last variable included in the intervention, the teaching of Islamic culture for children, a significant improvement was found in the scores. Educating children through this strategy has been recommended as a way of erasing prejudices and stereotypes towards other cultures in the first years of a person's life [67], and experiences with serious games, such as *It's a Deal*, [68] confirm that intercultural awareness can be improved using these tools. While the concepts explained during the serious game are quite simple (some of them related with religion, typical food, how immigrant camps work for refugees, etc), it was seen that the children showed a particular interest on the episodes regarding Islamic Culture. The authors suggest that this also can be related to the "change of scenery" conducted in the episodes of the game regarding this topic.

It should also be noticed that, while both schools seem to have a significantly different performance during the pre-measures, the intervention seems to equalize the post scores from the students, eliminating the significant differences (and, therefore, it can be assumed that the intervention has a similar impact in both groups).

B. QUESTIONNAIRE OUTCOMES

Finally, the analysis of the questionnaire shows that the learning experience was very welcomed by the students, specially by the students of the School1.

Indeed, students from the first school were more likely to enjoy the game, to find it more funny and to like the complementary activities. Moreover, they also valued the educational impact of the game more positively than the students from School2. This may be due to the fact that the children in School1 showed a greater predisposition for video games. In fact, the comments collected on negative aspects of the game came from students who also stated that did not usually play video games. Moreover, the better perception of the students in School1 may also be due to the fact that teachers, despite having the same materials and guidelines, were able to conduct the sessions in a slightly different way, such as introducing the concepts about psychological skills themselves (using the video as supporting material). It shall be considered that preference for the video game could be related to both age and gender, as School2 is totally composed by girls. Differences in the interest for video games have been found both by age and gender in the literature [69], which supports the pattern found in this article. While the interest of all the groups concerning the video game was high or moderately high, maybe it could be considered that the game should be adapted to fit the audience preferences in future iterations.

VIII. CONCLUSION

This paper presented a program called YoungRes aimed to improve resilience against polarization ideologies. To do so, the authors presented three objectives: i) adaptation of a traditional program into a serious game intervention, ii) use of behavioural measures instead of self-perceived ones to assess

the students' progress, and iii) validation of the intervention itself in two Spanish schools. Those three objectives were accomplished during the previous sections of this article: a traditional program, named Fortius, was adapted to a serious game based intervention; measurements of the students behavior and answers during the game were used as evolution measurement of their resilience; and the intervention was validated with a real sample of students. The validation performed through a case study with 36 students shows that the video game was useful to improve active listening, the student's breathing control and their knowledge about other cultures. In addition, student feedback indicated that the learning experience was very much appreciated and motivated them to participate more in the intervention..

Two main limitations (both of them related) can be highlighted from the case study, namely the large number of psychological skills addressed by the YoungRes program and the small sample size of the interventions. During the YoungRes program, 11 psychological skills are addressed, each one in a one-hour session. Including all this content in 11 sessions was a difficult task for many reasons, such as, the complexity of some of the concepts that need to be explained in only one hour (like self-instructions), or the limited available time included in the sessions to talk specifically about the theoretical concepts approached during the gameplay, among others. In addition, due to the large number of psychological skills, the duration of the intervention requires a lot of time from the schools, and this, together with the fact that if a student misses one or two sessions, he/she has to be considered absent from all of them, has lead to smaller than expected sample sizes. Therefore, here lies a complex decision: to make the video game longer, to cover more content, or to make it shorter and attract more stakeholders. However, the authors considered that the program should prioritize correctly explaining the psychological skills, even if that meant to extend the intervention. Probably the problem of the limited sample could be overcome with extra organization between the schools and the research group, but extra sessions would ensure that the content already presented is clearly understood by the students.

In conclusion, although it is true that there are some points of the intervention that need to be improved, it is also true that significant changes were found in the children's behaviour after playing the serious video game. Furthermore, the feedback received by the students during the intervention demonstrates that this approach encourages and motivates the children in a way that other traditional interventions do not, which in our opinion, is the greatest strength of the YoungRes program.

REFERENCES

- [1] A. Klapsis, "Economic crisis and political extremism in Europe: From the 1930s to the present," *Eur. View*, vol. 13, no. 2, pp. 189–198, Dec. 2014.
- [2] E. J. Helsper and R. Eynon, "Digital natives: Where is the evidence?" *Brit. Educ. Res. J.*, vol. 36, no. 3, pp. 503–520, Jun. 2010.
- [3] H. Tajfel, "Social identity and intergroup behaviour," *Social Sci. Inf.*, vol. 13, no. 2, pp. 65–93, Apr. 1974.
- [4] T. Pels and D. J. de Ruyter, "The influence of education and socialization on radicalization: An exploration of theoretical presumptions and empirical research," *Child Youth Care Forum*, vol. 41, no. 3, pp. 311–325, Jun. 2012.
- [5] J. Horgan, N. Shortland, and S. Abbasciano, "Towards a typology of terrorism involvement: A behavioral differentiation of violent extremist offenders," *J. Threat Assessment Manage.*, vol. 5, no. 2, p. 84, 2018.
- [6] I. Gilpérez-López, J. Torregrosa, M. Barhamgi, and D. Camacho, "An initial study on radicalization risk factors: Towards an assessment software tool," in *Proc. 28th Int. workshop database expert Syst. Appl. (DEXA)*, Aug. 2017, pp. 11–16.
- [7] L. A. Annetta, "Video games in education: Why they should be used and how they are being used," *Theory Into Pract.*, vol. 47, no. 3, pp. 229–239, Jul. 2008.
- [8] C. Malliarakis, M. Satratzemi, and S. Xinogalos, "CMX: The effects of an educational MMORPG on learning and teaching computer programming," *IEEE Trans. Learn. Technol.*, vol. 10, no. 2, pp. 219–235, Apr. 2017.
- [9] O. Gursesin, M. Akdag, A. Alasag, and I. Avest, "Playful religion: An innovative approach to prevent radicalisation of muslim youth in Europe," *Religions*, vol. 11, no. 2, p. 67, Jan. 2020.
- [10] S. Flood, N. A. Craddock-Henry, P. Blackett, and P. Edwards, "Adaptive and interactive climate futures: Systematic review of serious games' for engagement and decision-making," *Environ. Res. Lett.*, vol. 13, no. 6, Jun. 2018, Art. no. 063005.
- [11] F. X. M. Carrillo, L. M. L. Uribebarrea, J. E. Sánchez, and M. O. O. S. Amor, *Programa FORTIUS: Fortaleza Psicológica y Prevención de las Dificultades Emocionales*. Ediciones Pirámide, 2013.
- [12] D. Leutner and J. L. Plass, "Measuring learning styles with questionnaires versus direct observation of preferential choice behavior in authentic learning situations: The visualizer/verbalizer behavior observation scale (VV-BOS)," *Comput. Hum. Behav.*, vol. 14, no. 4, pp. 543–557, Dec. 1998.
- [13] H. Barriera-Viruet, T. M. Sobeih, N. Daraiseh, and S. Salem, "Questionnaires vs observational and direct measurements: A systematic review," *Theor. Issues Ergonom. Sci.*, vol. 7, no. 3, pp. 261–284, May 2006.
- [14] S. Vanistendael, "Resilience and spirituality," *Resilience in Palliative Care: Achievement in Adversity*. 2007, pp. 115–135.
- [15] M. E. Wimelius, M. Eriksson, J. Kinsman, V. Strandh, and M. Ghazinour, "What is local resilience against radicalization and how can it be promoted? A multidisciplinary literature review," *Stud. Conflict Terrorism*, pp. 1–18, Nov. 2018.
- [16] M. Pusey, K. W. Wong, and N. A. Rappa, "Resilience interventions using interactive technology: A scoping review," *Interact. Learn. Environments*, pp. 1–16, Jun. 2020.
- [17] C. Knight, "A resilience framework: Perspectives for educators," *Health Educ.*, vol. 107, no. 6, pp. 543–555, Oct. 2007.
- [18] Q. Q. Tiêt and D. Huizinga, "Dimensions of the construct of resilience and adaptation among inner-city youth," *J. Adolescent Res.*, vol. 17, no. 3, pp. 260–276, May 2002.
- [19] A. R. Feddes, L. Mann, and B. Doosje, "Increasing self-esteem and empathy to prevent violent radicalization: A longitudinal quantitative evaluation of a resilience training focused on adolescents with a dual identity," *J. Appl. Social Psychol.*, vol. 45, no. 7, pp. 400–411, Jul. 2015.
- [20] F. Lösel, D. Bender, I. Jugl, and S. King, "Resilience against political and religious extremism, radicalization, and related violence: A systematic review of studies on protective factors," *Understanding Recruitment to Organized Crime and Terrorism*. 2020, pp. 55–84.
- [21] J. D. Mayer, "What is emotional intelligence?" in *Emotional Development and Emotional Intelligence*, P. Salovey and D. J. Sluyter, Eds. 1997.
- [22] M. A. Brackett and P. Salovey, "Measuring emotional intelligence with the mayer-salovey-caruso emotional intelligence test (MSCEIT)," *Psycothema*, vol. 18, pp. 34–41, 2006.
- [23] B. Kun and Z. Demetrovics, "Emotional intelligence and addictions: A systematic review," *Substance Use Misuse*, vol. 45, nos. 7–8, pp. 1131–1160, May 2010.
- [24] A. Aradilla-Herrero, J. Tomás-Sábado, and J. Gómez-Benito, "Associations between emotional intelligence, depression and suicide risk in nursing students," *Nurse Educ. Today*, vol. 34, no. 4, pp. 520–525, Apr. 2014.
- [25] J. A. Casas, R. Ortega-Ruiz, and R. Del Rey, "Bullying: The impact of teacher management and trait emotional intelligence," *Brit. J. Educ. Psychol.*, vol. 85, no. 3, pp. 407–423, Sep. 2015.
- [26] E. Domínguez-García and P. Fernández-Berrocal, "The association between emotional intelligence and suicidal behavior: A systematic review," *Frontiers Psychol.*, vol. 9, p. 2380, Nov. 2018.
- [27] M. Ma, A. Oikonomou, and L. C. Jainm, *Serious Games Edutainment Applications*. London, U.K.: Springer-Verlag, 2011.

- [28] M. F. Young, S. Slota, A. B. Cutter, G. Jalette, G. Mullin, B. Lai, Z. Simeoni, M. Tran, and M. Yukhymenko, "Our princess is in another castle: A review of trends in serious gaming for education," *Rev. Educ. Res.*, vol. 82, no. 1, pp. 61–89, 2012. [Online]. Available: <http://journals.sagepub.com/doi/pdf/10.3102/0034654312436980>
- [29] A. Berns, A. Gonzalez-Pardo, and D. Camacho, "Game-like language learning in 3-D virtual environments," *Comput. Educ.*, vol. 60, no. 1, pp. 210–220, Jan. 2013.
- [30] A. Gonzalez-Pardo, A. Rosa, and D. Camacho, "Behaviour-based identification of Student communities in virtual worlds," *Comput. Sci. Inf. Syst.*, vol. 11, no. 1, pp. 195–213, 2014, doi: [10.2298/CSIS130214003G](https://doi.org/10.2298/CSIS130214003G).
- [31] D. López-Fernández, A. Gordillo, P. P. Alarcón, and E. Tovar, "Comparing traditional teaching and game-based learning using teacher-authored games on computer science education," *IEEE Trans. Educ.*, vol. 64, no. 4, pp. 1–7, Nov. 2021.
- [32] A. Gordillo, D. Lopez-Fernandez, S. Lopez-Pernas, and J. Quemada, "Evaluating an educational escape room conducted remotely for teaching software engineering," *IEEE Access*, vol. 8, pp. 225032–225051, 2020.
- [33] A. Gordillo, D. Lopez-Fernandez, and E. Tovar, "Comparing the effectiveness of video-based learning and game-based learning using teacher-authored video games for online software engineering education," *IEEE Trans. Educ.*, early access, Jan. 24, 2022, doi: [10.1109/TE.2022.3142688](https://doi.org/10.1109/TE.2022.3142688).
- [34] A. Berns, A. Gonzalez-Pardo, and D. Camacho, "Combining face-to-face Learning with online learning in virtual worlds," in *Proc. Eur. Assoc. Comput. Assist. Lang. Learn. Conf. (EUROCALL)*, 2012, pp. 1–5.
- [35] A. Berns, A. Gonzalez-Pardo, and D. Camacho, "Designing videogames for foreign language learning," in *Proc. 4th Int. Conf. ICT Lang. Learn.*, Florence, Italy, 2011.
- [36] C. Malliarakis, M. Satratzemi, and S. Xinogalos, "Designing educational games for computer programming: A holistic framework," *Electron. J. e-Learn.*, vol. 12, no. 3, pp. 281–298, 2014.
- [37] J. Huizinga, *Homo Ludens*. Madrid, Spain: Alianza, 1972.
- [38] J. Juul, *Half-Real: Video Games between Real Rules and Fictional Worlds*. Cambridge, MA, USA: MIT Press, 2005.
- [39] U. Ritterfeld, M. Cody, and P. Vorderer, *Serious Games: Mechanisms and Effects*. London, U.K.: Routledge, 2009.
- [40] D. Michael and S. Chen, *Serious Games: Games That Educate, Train, and Inform*. Boston, MA, USA: Thomson Course Technology PTR, Oct. 2006.
- [41] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, "From game design elements to gamefulness: Defining 'gamification,'" in *Proc. 15th Int. Academic MindTrek Conf. Envisioning Future Media Environ. (MindTrek)*, 2011, pp. 9–15.
- [42] E. Smith and L. Golding, "Use of board games in higher education literature review," *MSOR Connections*, vol. 16, no. 2, p. 24, Mar. 2018.
- [43] D. Clark, *Games e-Learning*. Epic Group, 2003.
- [44] Y. Zhonggen, "A meta-analysis of use of serious games in education over a decade," *Int. J. Comput. Games Technol.*, vol. 2019, pp. 1–8, Feb. 2019.
- [45] R. Menéndez-Ferreira, J. Torregrosa, A. Maldonado, R. Ruiz-Barquin, and D. Camacho, "A gamification approach to promote sports values," in *Proc. CEUR Workshop Proc.*, vol. 2166, 2018.
- [46] J. A. Caballero-Hernández, M. Palomo-Duarte, and J. M. Dodero, "Skill assessment in learning experiences based on serious games: A systematic mapping study," *Comput. Educ.*, vol. 113, pp. 42–60, Oct. 2017.
- [47] M. Colder Carras, A. Kalbarczyk, K. Wells, J. Banks, R. Kowert, C. Gillespie, and C. Latkin, "Connection, meaning, and distraction: A qualitative study of video game play and mental health recovery in veterans treated for mental and/or behavioral health problems," *Social Sci. Med.*, vol. 216, pp. 124–132, Nov. 2018.
- [48] J. G. Tichon and T. Mavin, "Experiencing resilience via video games: A content analysis of the PlayStation blog," *Social Sci. Comput. Rev.*, vol. 35, no. 5, pp. 666–675, Oct. 2017.
- [49] F. Zurita-Ortega, R. Chacón-Cuberos, M. Castro-Sánchez, F. Gutiérrez-Vela, and G. González-Valero, "Effect of an intervention program based on active video games and motor games on health indicators in university students: A pilot study," *Int. J. Environ. Res. Public Health*, vol. 15, no. 7, p. 1329, Jun. 2018.
- [50] J. Torregrosa, R. Lara-Cabrera, G. Bello-Orgaz, and P.-C. Shih, "Inducción de emociones a través del diseño de videojuegos," in *Proc. 18th Conferencia de la Asociación Española Para la Inteligencia Artificial*, 2018, pp. 1046–1051.
- [51] K. Schrier, "Ethical thinking and video games: The practice of ethics in fable iii," Ph.D. dissertation, Doctoral dissertation, 2011.
- [52] S. Paracha, S. Jehanzeb, and O. Yoshie, "A serious game for inculcating Islamic values in children," in *Proc. Taibah Univ. Int. Conf. Adv. Inf. Technol. Holy Quran Sci.*, Dec. 2013, pp. 172–177.
- [53] T. Fleming, R. Dixon, C. Frampton, and S. Merry, "A pragmatic randomized controlled trial of computerized CBT (SPARX) for symptoms of depression among adolescents excluded from mainstream education," *Behavioural Cognit. Psychotherapy*, vol. 40, no. 5, pp. 529–541, Oct. 2012.
- [54] E. A. Schoneveld, M. Malmberg, A. Lichtwarck-Aschoff, G. P. Verheijen, R. C. M. E. Engels, and I. Granic, "A neurofeedback video game (MindLight) to prevent anxiety in children: A randomized controlled trial," *Comput. Hum. Behav.*, vol. 63, pp. 321–333, Oct. 2016.
- [55] H. Scholten, M. Malmberg, A. Lobel, R. C. M. E. Engels, and I. Granic, "A randomized controlled trial to test the effectiveness of an immersive 3D video game for anxiety prevention among adolescents," *PLoS ONE*, vol. 11, no. 1, Jan. 2016, Art. no. e0147763.
- [56] K. Shandley, D. Austin, B. Klein, and M. Kyrios, "An evaluation of 'Reach out Central': An online gaming program for supporting the mental health of young people," *Health Educ. Res.*, vol. 25, no. 4, pp. 563–574, Aug. 2010.
- [57] C. Rogers and R. Farson, *Active Listening*. Mockingbird Press LLC, 2021.
- [58] M.-A.-R. Butt and D. Dunne, "Rebel girls and consequence in life is strange and the walking dead," *Games Culture*, vol. 14, no. 4, pp. 430–449, Jun. 2019.
- [59] P. Ekman, "Are there basic emotions," *Tech. Rep.*, 1992.
- [60] D. Erimspan, A. Hemphill, and S. Nowicki, "Improving the ability of elementary school-age children to identify emotion in facial expression," *J. Genetic Psychol.*, vol. 164, no. 1, pp. 88–100, Mar. 2003.
- [61] O. Golan, E. Ashwin, Y. Granader, S. McClintock, K. Day, V. Leggett, and S. Baron-Cohen, "Enhancing emotion recognition in children with autism spectrum conditions: An intervention using animated vehicles with real emotional faces," *J. Autism Develop. Disorders*, vol. 40, no. 3, pp. 269–279, Mar. 2010.
- [62] F. Aysar and S. A. Alkaya, "The effectiveness of assertiveness training for school-aged children on bullying and assertiveness level," *J. Pediatric Nursing*, vol. 36, pp. 186–190, Sep. 2017.
- [63] S. H. Spence, "Social skills training with children and young people: Theory, evidence and practice," *Child Adolescent Mental Health*, vol. 8, no. 2, pp. 84–96, May 2003.
- [64] E. F. Akinsola and A. D. Nwajei, "Test anxiety, depression and academic performance: Assessment and management using relaxation and cognitive restructuring techniques," *Psychol.*, vol. 4, no. 6, p. 18, 2013.
- [65] O. Asikhia, "Effect of cognitive restructuring on the reduction of mathematics anxiety among senior secondary school students in Ogun state, Nigeria," *Int. J. Educ. Res.*, vol. 2, no. 2, pp. 1–20, 2014.
- [66] A. Parnandi, B. Ahmed, E. Shipp, and R. Gutierrez-Osuna, "Chill-out: Relaxation training through respiratory biofeedback in a mobile casual game," in *Proc. Int. Conf. Mobile Comput., Appl., Services*. Springer, 2013, pp. 252–260.
- [67] R. Elbih, "Teaching about islam and muslims while countering cultural misrepresentations," *Social Stud.*, vol. 106, no. 3, pp. 112–116, May 2015.
- [68] V. Guillén-Nieto and M. Aleson-Carbonell, "Serious games and learning effectiveness: The case of It's a deal!" *Comput. Educ.*, vol. 58, no. 1, pp. 435–448, Jan. 2012.
- [69] B. S. Greenberg, J. Sherry, K. Lachlan, K. Lucas, and A. Holmstrom, "Orientations to video games among gender and age groups," *Simul. Gaming*, vol. 41, no. 2, pp. 238–259, Apr. 2010.



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