



CONFIDENCE

D5.4: RESULTS INTERPRETATION - GAMES EVALUATION

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732420.

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WP5 Evaluation of metrics

Task 5.3 DATA ANALYSIS. ANALYSIS OF THE DIFFERENCES BETWEEN PRE AND POST-TEST.

D5.4 RESULTS INTERPRETATION – GAMES EVALUATION.

Contract number:	732420
Project acronym:	e-Confidence
Project title:	Confidence in behaviour changes through serious games
Delivery date:	31/08/2018
Author(s):	Svjetlana Kolić-Vehovec, Sanja Smojver-Ažić, Barbara Rončević Zubković, Tamara Martinac Dorčić, Ana García-Valcárcel Muñoz-Repiso, Ana Iglesias Rodríguez, Verónica Basilotta Gómez-Pablos, Carlos Alberto Catalina Ortega, Mario Félix Rodríguez Martínez
Partners contributed:	ITCL, Nurogames
Date:	04/10/2018
Version:	3.1
Abstract:	<p>This document presents the overall games evaluation of based on:</p> <ul style="list-style-type: none"> - differences between pre- and post-test in experimental and control groups on all dependent variables (knowledge, behaviour, TPB variables, personal variables) - data regarding games' user experience - data regarding in-game metrics <p>The conclusions of evaluation will be base for the recommendation of the developed serious games on</p>

	specific target group of children.
Status:	<p>X PU (Public)</p> <ul style="list-style-type: none"> ● PP Restricted to other programme participants (including the Commission Services) ● Restricted to a group specified by the consortium (including the Commission Services) (please specify the group) ● Confidential, only for members of the consortium (including the Commission Services)



DOCUMENT REVISION LOG

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	27/07/2018	The draft contains information about contents of the document	FHSS
0.2	10/09/2018	Input about evaluation of the School of Empathy game	FHSS
0.3	25/09/2018	Input about evaluation of the Go Online game	USAL
1.0	26/09/2018	First draft	FHSS
1.1	27/09/2018	Input about methodology for game development	ITCL
2.0	27/09/2018	Second draft	FHSS
3.0	03/10/2018	Final version	FHSS
3.1	04/10/2018	Revision before submission – minor changes only	ITCL



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3. INTRODUCTION

This document relates to Result interpretation - Game evaluation in accordance with the Grant Agreement. The document has been elaborated by FHSS Rijeka with the major input from USAL and ITCL, as well as input from all other partners.

This report is related to all other work packages of the eConfidence project, but is most closely related to D5.3. Data analysis results: Analysis of the differences between pre and post-test.

The main contribution of the e-Confidence project in the scientific context should be validation of an experimental methodology for the design and evaluation of serious game mechanics, as well as the overall design for a game aiming to introduce behavioural changes within a defined scope i.e. Safe use of internet and Bullying.

Since the serious games that have been developed within the eConfidence project consider Safe Use of Internet and Bullying, these are the main target behaviours for validation. Due to the broad possibilities and outcomes of behavioural changes according to the project description in the Grant Agreement (ANEX 1, Part B, pg. 14), the initial target behavioural changes (divided by scope) to be analysed during the pilot tests are the following:

Safe Use of Internet

S1. Increased awareness of consequences and of interacting in a social on-line environment. Sense of privacy, avoidance of harassment or support of improper/anti-social behaviour. Self-awareness of his/her "virtual self" and implications and importance of concepts such as: anonymity, libel, right-to-be-forgotten.

S2. Incorporation of safe behaviour when using an internet-enabled device: knowledge of risky behaviour and common strategies of social engineering (phishing, fake credentials).

S3. Self-monitoring of excessive or improper usage of Internet. Increased awareness of the importance to use internet and its facilities as a communication, research and empowering tool, but not as replacement to real-world interactions and activities.

Bullying

B1. Improved adequate assertive and empathic behaviour in potential bullying contexts. Observed decreasing on hostile or by-standing behaviour.

B2. Increased acceptance of differences and non-hostility towards colleagues. Increased awareness of the impact of one's actions over others and cooperative behaviour.

B3. Incorporation of reprove of anti-social behaviour at individual and group-level.



Common behavioural changes from both interventions

C1. Smaller degree of rejection towards gamified solutions in non-leisure environments by the Players. Correlation of positive feelings and cooperative attitude with improvement of acceptable/responsible behaviour.

C2. Awareness and understanding of the consequences of the effects of improper behaviour with immediate/short term satisfaction or social promotion in themselves and their environment (colleagues, society, etc.).

In order to verify whether the use of e-Confidence games causes changes in the variables considered as dependent, a quasi-experimental, pre-test-post-test design with experimental and control groups was followed. Experimental groups participated in an educational activity with the e-Confidence games. In order to assert the efficacy of the experiment a separated control group of students without intervention was engaged in the use of the serious game, but still was evaluated by the same external metrics as the tested group.

The purpose of collecting data in pre- and post-test as well as in gaming sessions was to analyse the cognitive, emotional and behavioural changes produced by the gaming sessions in order to evaluate effectiveness of games mechanics in producing changes through ABA procedures.

The games, named Go Online (related to safe use of internet), and School of Empathy (related to bullying prevention) were tested in pilot sessions in ten different Spanish and English speaking schools to assess changes in students' behaviour, knowledge, variables related to intention to change the behaviour and personal variables.

Interpretation of the results will be done according to the highest research standards taking into account all the constraints and possible uncontrollable sources of error. Conclusions regarding stated hypothesis will be drawn based on the obtained results. The results will be interpreted in relation with the theoretical assumptions and the results of previous studies. Overall games evaluation will be made based on differences between pre- and post-test in experimental and control groups on knowledge and attitudes toward bullying and the safe use of internet, motivation, behavioural intentions, and behaviour of students. The games will be additionally evaluated according to the games' user experience.

Moreover, the metrics obtained through the platform are used in a Big Data analysis where dependencies between playing behaviour and test results are analysed. The aim of this analysis is to find possible behaviours in the players indicative of their initial status or their inducted change. These dependencies have been measured using Mutual Information (MI) between selected variables in tests results and game playing behaviour data. This analysis is performed only in the experimental groups playing Go Online Game and School of Empathy

Game. In this regard, playing behaviours have been analysed using selected multidimensional variables which allow a thorough analysis of the metrics importance.

The evaluation conclusions will be base for the recommendation of the developed serious games on specific target group of children. These recommendations can be used by final users (schools), but also by all other interested communities.



4. EVALUATION OF “GO ONLINE” GAME

4.1. THE EFFECTS OF THE “GO ONLINE” GAME ON TARGET VARIABLES

The studied target variables refer to the knowledge and behaviours related to the safe use of internet as well as variables from Theory of Planned Behaviour (attitudes, control, self-efficacy, subjective norms and behavioural intentions).

4.1.1. KNOWLEDGE

Functioning in the information society gives the opportunity for quick access to the exchange of information, but also determines human behaviour. We can find different websites to connect people in networks of friends, but they also imply the possibility to share confidential data such as age, place of residence, e-mail address, private pictures, occupation, hobbies and other sensitive data. Protection of network image requires, first of all, developing a certain level of competence among the youngest generation – according to the principle that says “information, picture, file once uploaded stays on the Internet forever”.

Also young Internet users should be aware of how new media mechanisms work, how quick the information can spread online and legal consequences result from using the Internet in a manner not compliant with the netiquette or the law.

In order to assess the knowledge about safe use of internet students were asked what they would do in certain fictitious situations (for example, when they create a password to access to an internet service, or when they participate in an online game...).

The results of analysis show that neither in English nor in Spanish schools there are significant differences in knowledge about the safe use of the Internet once it has been intervened through the video game “Go Online”.

The application of the video game has been useful, more than to increase the knowledge about the students, to review, reinforce and fix more knowledge about safe Internet use, which had previously. However, it is necessary to continue working more on some aspects related to this topic, such as: raising awareness about privacy, parents' perception of young people's online safety, parental guidance, views on online safety, generational gap, etc.;

because the future challenge in this area is maximize the positive effects and minimize the negative effects.

Recent research results show that systematic use of the electronic media begins already at the age of 7–11 connected mainly with entertainment and communication functions offered by this type of devices. The report published by Vincent (2015), based on our two major European-wide research projects: the EU Kids Online, and Net Children Go Mobile, and involving interviews with thousands of children across the continent, sets out to examine the potentially positive online experiences that mobile opportunities present to children and young people aged 9-16.

With the arrival of smartphones and tablets and the convergence of technologies, device use has become ever more intimate. Besides, with the miniaturization of mobile devices, viewing or reading in private spaces have become even more possible. Children are now able to access the internet by their own far away from public oversight or control. For many of them, this becomes the linchpin for their social well-being as they can start exploring and understanding their identity. This interaction with their phone on a daily basis results in the device being imbued with emotion and personal content.

4.1.2. BEHAVIOUR RELATED TO SAFE USE OF INTERNET

The measure of how active children are when they are online is expressed in terms of the “ladder of online opportunities”. Children stated the amount of time they used the internet, the skills they had, the number of activities they did online and how often they carried them out. This shows that children vary in skills and confidence regarding to the use of internet and the different devices they use to get online.

The Internet offers a lot of benefits to consumers, such as 24 hours accessibility, improved interactivity, and convenience. However, these improvements also make it easier and more widespread to have an unethical use of the Internet (Akbulut, Sahin, & Eristi, 2010; Davinson & Silence, 2010; Namlu & Odabasi, 2007).

In this study we have analysed the behaviour of children through various situations. Once analysed children progress before and after playing “Go Online” a playing behaviour analysis is performed through dependencies between playing statistics and both, the initial knowledge about safe use of the Internet and the improvement of this knowledge. The dependency is measured with the normalized MI.



The results show that there is not any significant dependency but between the number of played times of each game section and the improvement of Knowledge about safe use of the internet. However, the significance is too small to make any conclusion.

4.1.3. TPB VARIABLES RELATED TO SAFE USE OF INTERNET

There is a need to increase coping self-efficacy for individuals of all ages and backgrounds. It is essential to understand what message cues related to online safety are successful in eliciting protective behaviours through activating threat and coping appraisal processes. The research of Shillair, Cotton, Tsai, Alhabash & LaRose (2015) found the efficacy of a multi-pronged strategy. The safety deficits of the most vulnerable Internet users – those lacking knowledge about how to handle changing online threats – might be overcome by stressing personal responsibility for online safety together with providing vicarious experience with protective measures. When personal responsibility was stressed, providing naïve users with vicarious experiences with safe online behaviours had a greater effect on safety intentions than merely telling them that it was easy to protect themselves through safety tips. Protection motivation theory (PMT) provides a theoretical framework for understanding Internet users' security protection that has informed past research (Tsai, Jiang, Alhabash, LaRose, Rifon & Cotton, 2016).

Technology adoption studies typically predict behavioural outcomes by investigating the relationship between attitudes and intentions, though the intention may not be the best predictor of actual behaviour. Meanwhile, Shropshire, Warkentin & Sharma (2015) defend that personality constructs have recently been found to explain even more variance in behaviour, thus providing insights into user behaviour. Their research incorporates conscientiousness and agreeableness into a conceptual model of security software use. Attitudinal constructs perceived ease of use and perceived usefulness were linked with behavioural intent, while the relationship between intention and actual use was found to be moderated by conscientiousness and agreeableness.

Tomczyk & Kopecky (2016) present research results concerning sharing confidential data and risky behaviours that are derived from it among the young Internet users in Poland and the Czech Republic. They highlight that the key factor differentiating the safety of e-activity of each young network media user is the attention of his/her significant others and their readiness to get involved in the process of entering into the cyberspace of digital natives. This state is possible to achieve only through possession of profound knowledge on the

influence of electronic media by the significant others. The word 'space' should be underlined – space which is a virtual source of cognitive and social experiences for young people, which shapes their sensitivity and their thinking and behavioural patterns in interpersonal relations.

We have studied the variables from Theory of planned behaviour (TPB) are attitudes towards the safe use of internet, perceived behavioural control and self-efficacy, subjective norms and behavioural intention.

Firstly students from different groups have shown good attitudes towards the safe use of the internet. But the attitudes of the students in English and Spanish schools have not been modified either after the application of the video game. It is difficult to modify attitudes when the application time is very limited and certain previously acquired behaviours may exist, which condition the short-term change of these before a complex and current issue such as the safe use of the Internet in ages between which the population under study is located. It is true that although more and more common use of social networks and different mobile devices, not always preteens are aware of the risks that certain jobs entail. This change of attitude requires time and maturity to obtain significant differences and a true modification of behaviours in this sense.

Regarding the perceived behavioural control, the results show that it has not changed with the application of video game. Consequently, we do not consider that the game has influenced at the time of improving such behaviour control. But we consider that the limited temporal application of the videogame, may have been the reason why there have been no changes in this variable.

On the other hand, the variable self-efficacy to use the Internet more safely has not been affected by the application of the video game among Spanish students, so that the data reflect, as in the English centers and the entire sample, the absence of significant differences between the scores pre-test and post-test in the three groups.

The perception that students have with respect to the social pressure of the family, friends and teachers to make a safe use of the Internet is high and it has not been influenced by having played and performed activities in different contexts, in relation to this topic.

Finally, the analysis carried out to verify to what extent the application of the video game has had an impact on the students of English and Spanish schools, in terms of the intention of safe use of the Internet, does not show significant differences between the pre-test and

post-test scores. This could be because some activities have already been done on this subject through other initiatives and programs, so that the students were already sensitized towards safe use of the Internet. We could also infer that the videogame application time has not been enough to modify those behaviour intentions.

4.2. PLAYER EXPERIENCE OF “GO ONLINE” GAME

The scale for measuring the game experience consisted of seven dimensions: Immersion, Tension, Competence, Flow, Negative Affect, Positive Affect, Challenge. The best valued dimension has been the competence, related to feel skilful and successful in the context of the game Go Online. Secondly the positive affect, what means they have enjoyed, more in the English speaking sample. In contrast, the lowest rated dimension has been the challenge, so they did not feel enough challenged playing the game. The game also did not achieve the immersion and desirable flow for students.

According to the qualitative analysis of their statements, as positive aspects, it should be noted that the majority of students emphasize that the game allows them to learn about the safe use of the internet, fundamentally with regard to the creation of secure passwords since they consider that although this aspect is not explained to them in class, it is a useful content for their daily life.

Regarding the drawbacks, the vast majority of comments are directed to highlighting that it is boring, and that it is repetitive. The game technically lacks details to work properly. It is usually slow or it stops unexpectedly and they have to restart it again. The students emphasize that the game has not helped them to learn about the subject or that they have not liked the tasks to be carried out.

4.3. “GO ONLINE” GAME METRICS

4.3.1. RELATION BETWEEN MINI-GAME “SAFE FRIENDS” VARIABLES AND GAME METRICS

The mini-game called "Safe Friends" presents situation in which the player decides if certain characters are reliable people (friends) or not, taking into account that it is very common to find that adolescents add to their social networks not only friends but also strange people, becoming a high risk behaviour that can seriously affect their life if they do not make an appropriate use of the Internet. The results of the analyses carried out indicate that there is

no significant difference in the number of strangers rejected or accepted to be included in the social networks of the population under study. Similarly, the data shows that the number of rejected friends did not decrease either, which means that students are learning to distinguish between people who are reliable and those who are not. In this regard, it is worth noting that there is a significant difference between the first time they played the game and the last time they did it in terms of rejected friends when analysing the complete sample. The result obtained shows that the number of times the students played to the mini-game contributed to change their behaviour by rejecting fewer friends and, consequently, their learning was improved when it came to distinguishing between reliable and unreliable people.

Regarding the number of accepted friends, understood by these, those characters of the game who are reliable and must be accepted in their social networks, there are no significant changes in the sample.

4.3.2. RELATION BETWEEN MINI-GAME “PASSWORDS” VARIABLES AND GAME METRICS

On the other hand, in the mini-game "Passwords" based mainly on the adequate selection of passwords in different services (social networks, email account, online platforms, ...), the data obtained in the metrics indicate that the students are learning to distinguish which passwords are not good to use by increasing the number of very weak and weak passwords bounced. As for the weak bounced passwords, there is a significant difference in the total sample, showing that the number of times the students played the mini-game helped to change their behaviour, affecting the learning about the type of passwords that are more suitable to use.

Similarly, it has been noted that there has been a decrease in the number of very strong passwords that have been removed, which again indicates that students are learning to discriminate between passwords that are good and those that are bad.

We get this same result when we talk about very weak passwords used by players.

This fact is clear when players let pass these types of passwords and do not bounce them in the mini-game with the bar. That is, the fewer weak passwords are used at the end of the sessions, the better will be the behaviour of the students and the greater the learning as to the type of passwords that they should or should not use. In this sense, a significant difference has been found in the total sample, where it is appreciated that the number of

times the students played the mini-game, helped to change their behaviour using fewer weak passwords and, therefore, they learned about what passwords are not good to use, resulting in an increase in the number of strong and highly secure passwords used.

4.4. CONCLUSIONS REGARDING THE “GO ONLINE” GAME

The analysis carried out on knowledge and target behaviour about safe use of the Internet, taking into account the five dimensions related to Theory of Planned Behaviour (TPB): attitudes, perceived behaviour control, subjective norm and behaviour intention plus self-efficacy, reflects that the use of the video game “Go Online”, both with the sample of English speaking school children, and with that of Spaniards; as well as considering the complete sample, it has not generated the behaviour change expected initially.

After performing inferential analysis (two-factor ANOVA with repeated measures) for each dependent variable of safe use of the Internet, the multivariate contrast results have indicated that there were no significant differences between the pre-test and post-test scores in any of the three groups of subjects (one experimental and two control groups); there were no significant effect for group, time of measurement as well as no significant interaction effect.

As we have indicated throughout the study, we estimate that the limited time of application, the high starting scores of the students in the pre-test; and the on-going training that has been carried out for some years on the safe use of the Internet, may have been decisive factors in not finding significant differences. Concerning to the participation in prevention programs, the collected data indicate that 58% of children in Spanish and 49% of children in English speaking sample have participated in safe use of internet programs.

However, when the group of alumnus with less knowledge as well as less adequate behaviours and attitudes about the safe use of the Internet have been specifically studied, there have been some indications that children who have played the game "Go Online" have reached significantly positive scores in the post-test, in some cases being differentiated from the control groups, which we can interpret as a change of knowledge and behaviour due to the use of the game. However, in some cases, it has been found that the results improve upon having played either of the two games, which could show some interdependence of the contents treated in both games.



As for the analysis of the metrics obtained from the platform that gives access to the game "Go Online", two mini-games "Safe Friends" and "Passwords" have been analysed, through which the children have to show that they know how to select their friends on social networks and use strong passwords. The results allow us to conclude that the children who have more frequently played the Safe Friends mini-game have improved their ability to accept friends on social networks, they declined fewer reliable people, so they say "I have learned to distinguish reliable people from not reliable people". Through the mini-game "Passwords" children have improved their ability to distinguish good passwords, being able to reject weak passwords. Results showed there was a significant difference between the first and the last time in terms of number of weak passwords bounced away considering the number of times students played the game. The weak passwords used at the end of the sessions, evidence of the better behaviour acquired by students.

Given the increasing severity and prevalence of information security risks, a body of research on users' intentions to apply security measures to cope with such risks has been developed. These works largely focus on the emotional (e.g., fear) and rational (e.g., threat severity and likelihood and ability to engage in coping behaviour) drivers of users' intentions to engage in coping behaviours. These behaviours include, for instance, changing passwords frequently, complying with organizational security standards, and installing software against malicious attacks. Go Online game developed in the eConfidence project contributes to endeavours to improve behaviour of children toward more safe use of internet.



5. EVALUATION OF “SCHOOL OF EMPATHY” GAME

5.1. THE EFFECTS OF THE “SCHOOL OF EMPATHY” GAME ON TARGET VARIABLES

The studied target variables refer to the knowledge and behaviours related to bullying as well as variables from Theory of planned behaviour (attitudes, control, self-efficacy, subjective norms and behavioural intentions). The students’ personal characteristics have also been assessed: assertiveness, empathy, compassion for victim, social skills, and friendship, as well as their experience in the use of digital resources and video games, considering that all these variables can influence the knowledge, behaviours, and attitudes of the students about bullying and safe use of internet.

5.1.1. KNOWLEDGE

In order to assess the knowledge about bullying students were asked to recognize whether the described situation is bullying or not as well as to rate appropriateness of aggressive, passive or assertive reactions in the situations of bullying.

Pre- test and post-test results showed that students are good in recognizing the situations of bullying and in rating appropriateness of reactions in these situations.

Overall analyses of differences between pre and post-test in variables related to knowledge did not show the positive effects of the School of Empathy game. Students were well informed about bullying regardless whether they played School of empathy game or not. Only significant effect on knowledge was for the time of measurement. In post-test all students’ knowledge slightly decreased, although it was still good.

Results of Mutual Information from Big Data analysis do not show any dependency between knowledge about bullying and any of the variables analysed for the in game behaviour.

Furthermore, according to Big Data analysis Knowledge and improvement in the knowledge about all appropriate reactions has small dependency with the Answers provided in the game test after victim game play. A small effect has been detected for Knowledge about inappropriate reaction (aggressive reaction) where answering to the questions may be influenced by children initial knowledge that affect their learning. High levels of initial knowledge and low incidence of bullying behaviour and victimization in the students who participated in the study could be the explanation for lack of the game effect on the

knowledge about bullying and appropriate behaviours in bullying situations. Many students have been previously engaged in bullying prevention programs that inevitably had an effect on knowledge and behaviour. In addition, the call for participation in the research was open for all schools, but only schools that were interested applied, and it is possible that in those schools the awareness about bullying was already high. Also, parental and student consents that are prerequisite for participating in the research, may lead to biased sample (e.g. violent child would refuse to participate).

5.1.2. BEHAVIOUR IN BULLYING SITUATIONS

Variables related with behaviours in bullying situation were victimization and bullying behaviour. Students were asked how frequently they were victim of bullying and how often they behaved like bully at school in the last couple of months. According to the results of pre and post-test children were rarely victimized in the school, and rarely showed bullying behaviour.

Overall analyses of differences between pre and post-test in variables related to behaviour in bullying situations did not show the positive effects of the School of Empathy game.

The differences in pre-test and post-test data in Victimization were significant in total sample, although with very small effect. In Spanish sample, the students who played either School of empathy or Go Online game, reported more often about victimization in post-test than in pre-test in comparison to control group. One possible explanation of this result could be sensibilization of students to better recognize behaviours related to victimization. The results of Big Data analysis showed a small dependency between improvement in Victimization and the Interaction with bullies or as bully in the mini games. Although the way the children face the mini games might have influence in their learning, the significance of the MI value is too small to make any conclusion. Regarding the bullying behaviour, the results showed that all children in Spanish sample, regardless of playing the games or not, showed more bullying behaviour in post-test than in pre-test. In both time of measurement, the students reported low rate of bullying behaviour. The results of Big Data analysis showed a small dependency between pre-test results in bullying behaviour and time distribution in the game, but the value is small to make any conclusion. On the other hand, a new dependency is found with the answers provided after playing victim role, although also a small value. Although it was expected that the experience of playing School of Empathy game would decrease victimization and bullying behaviour, such effect is not easy to obtain

just as a result of the gaming activity. ABA procedure is usually applied in real life with close supervision of trained behaviour therapist. However, even in such application the effect of intervention is not found in all persons. In the period of students' gaming activity, different uncontrollable effects could affect students' behaviour. Since it was period at the end of school year with approaching annual exams, students probably became exposed to more stressful experiences and frustrations that could provoke undesirable bullying behaviour.

DeSmet et al. (2018) conducted similar study in order to evaluate the serious game FriendlyAttac to promote pro-social bystander behaviour in cyberbullying among young adolescents. They also did not find the game effect on cyberbullying involvement i.e. victimization and perpetration. However, the negative effect was obtained on cyberbullying witnessing. Vannini et al. (2011) found that non-involved bystanders changed into defenders after playing FearNot game only in one of two samples. These results suggest that serious games could lead to behaviour change, but that is not always the case, especially in complex behaviours like bullying.

5.1.3. TPB VARIABLES RELATED TO BULLYING

Variables from Theory of planned behaviour (TPB) for bullying are attitudes toward bullying and protecting the victim, perceived behavioural control and self-efficacy, subjective norms in protecting the victim and behavioural intention for helping victim.

Overall analyses of differences between pre and post-test in TPB variables related to bullying did not show the positive effects of the School of Empathy game.

The results in pre-test showed that students had negative attitude towards bullying. The analysis of differences between pre-test and post-test data showed that there was significant effect only for time of measurement on total sample and Spanish sample. Although students still had negative attitudes towards bullying, their attitudes in post-test became slightly less negative in all three groups.

The attitudes toward protecting the victim were positive and considered as good, beneficial, useful, powerful and wise, but not very safe both in pre-test and in post-test. However, the results showed that there was significant effect for time of measurement on total sample and English speaking sample. Students had slightly less positive Attitudes toward protecting the victim in post-test than in pre-test in experimental and control groups.

Results in TPB variables were mostly similar for pre-test and the post-test except for behavioural intention. Students had lower Behavioural intentions to protect the victim in post-test than in pre-test in all three groups although planned victim protection is relatively high. Students feel moderate level of subjective norm and self-efficacy in protecting the victim while the lowest score is for control. After experience of bullying situations during game playing, students recognized that it won't be easy to act correctly despite for the good intentions.

The results of Big Data analysis showed that small improvement scores in Attitudes toward bullying for answers in test after playing victim role and distribution of answers type in the dialogues. These results reinforce the idea that dialogues interactions are tools to identify children initial status and to modify their behaviour. Furthermore, significant dependency is found between pre-test results of Attitude towards protecting the victim and Dialogues Answers Distribution surpassing, which suggests the initial status affects the playing behaviour. For Control in protecting the victim the slight dependency was found between the pre-test results and the average time reacting to the answers in the dialogues, while for Self-efficacy there was no dependency. Two slight dependencies had been found for subjective norms (between improvement in tests and in-game test answers, and pre-test scores and question reaction time). The result for Behavioural intentions to protect the victim showed slight dependencies between pre-test results for Behavioural intentions and Bully identification and another between improvement in tests and speed obtaining points and levels in the mini-games.

DeSmet et al. (2018) found positive effects of the game on self-efficacy to end cyberbullying, but no significant effects were found on attitudes on supporting the victim in different ways, outcome expectancies, subjective norm for positive bystander behaviour, nor behaviour intentions. However, in their meta-analysis (DeSmet et al., 2014) effects of game playing in order to promote healthy life-style on self-efficacy were unexpectedly small.

Games could provide opportunity for experience in a safe environment, without real-life consequences when making wrong decisions. However, it is difficult to transfer game experience and behaviour to real situation, especially in high risk social situation such as bullying. Vannini et al. (2011) summarized the reasons why bystanders may hesitate to intervene during the aggressive interaction. Students may not appropriately comprehend the bullying dynamics and do not know how to react appropriately. Besides inadequate knowledge, the reason for not reacting might be diffusion of responsibility for protecting the

victim when there are several bystanders and no one reacts. Also, some students have fear of retaliation: children will not risk becoming the next victim.

5.1.4. PERSONAL VARIABLES

The analysis of personal variables of a social nature such as assertiveness, empathy, social skills, and friendship in pre-test showed that students tended to respond assertively to conflicts, and they rarely acted passively or aggressively, although in English speaking samples students have somewhat higher tendency to act passively. Students in both samples also manifested a high degree of empathy, social skills, and friendship, since most of them have a lot of friends at school (91% of the sample have 4 or 5 in Spanish schools, and 80% have more than 5 in English speaking schools) and they did not feel isolated (or alone) when playing.

In comparing pre-test and post-test results there were significant effects for time of measurement for assertive reaction, aggressive reaction, empathy, compassion for victim and social skills. Changes were in negative directions: in post- test students had lower assertive reaction, lower empathy, lower compassion for victim and lower social skills, and higher aggressive reactions (although the level of aggressive behavioural tendencies in social situations is still low). As already hypothesized, one possible reason for this finding was probably time of post-test i.e. end of school year that is usually stressful and full of tension for most students. Besides, some other uncontrollable factors (e.g. students' social experiences between pre and post-test), regardless of experience in playing serious game could have affected the change in the dependent variables.

The significant interaction between group and time of measurement was found in English speaking and Total sample: students who played both serious games increased slightly their aggressive tendencies in social situations. The effect was small and we have to take into account that students reported low levels of aggressive behavioural tendencies in social situations. Besides, the items in questionnaire that represent aggressive reactions mostly refer to mild verbal aggression.

Overall statistical analyses did not show the positive effects of the School of Empathy game on personal variables.

The results of the Big Data analysis showed small dependencies between pre-test results in assertiveness and playing behaviour variables. For aggressive reaction small dependencies in

pre-test with dialogues answers distribution and in improvement between tests with bully identification was found. Only a slight dependency is found between the pre-test results for Passive reactions and the achieved mini-games levels. For Empathy dependency was found between the improvement in Empathy and the dialogues answers distribution which suggests that how players answer and their change in empathy are related. The improvement of Social skills between pre and post-test has a stronger dependency with the Dialogue Answers Distribution. Small dependencies appear between improvement in Friendship and Dialogues Answers Distribution and Improvement Speed, and between pre-test and Bully Interaction Rates. DeSmet et al. (2018) found positive effects of the game on social skills, but no effect on empathic skills. The other studies on effectiveness of serious games in bullying prevention did not explore the effects on perceived social skills and empathy (e.g. Bosworth, Espelage, Dubay, Daytner, & Karageorge, 2000; Kärnä et al., 2013; Vannini et.al., 2011). Therefore, the effect of serious games on empathy and social skills should be further explored.

5.1.5. PROGRESS IN RECOGNITION OF ASSERTIVE REACTIONS AS APPROPRIATE IN BULLYING SITUATION AND EFFECT ON TARGET VARIABLES

Since the main goal of the eConfidence project was to explore whether the use of serious game can have a positive impact in behavioural change, in additional analysis we focused on students who differed in their progress related to recognition of assertive reactions as appropriate in bullying situation. We differentiated three groups: students whose results in knowledge about assertive reaction in bullying situations declined (about 20%), remain unchanged (about 60%) or improved (about 20%). We compared those three groups regarding target dependent variables. The analysis showed that playing the School of Empathy game pairing with improvement of knowledge of assertive as appropriate reactions in bullying situations can yield some positive results. Namely, it can prevent decline or enable improvement in recognizing bullying situations, attitudes toward protecting the victim and behavioural intention to help the victim, as well as assertive reactions in general. Also, more negative attitudes toward bullying were found in students who played School of Empathy game and who did not change or who improved their knowledge about assertive as appropriate reactions.

5.2. PLAYER EXPERIENCE OF “SCHOOL OF EMPATHY” GAME

According to data reported in D4.3 the results show that Spanish and English speaking students experienced same levels of positive experiences: immersion, competence, flow, positive affect, and challenge while playing the games. Students felt moderate levels of positive affect and competence, moderate levels of sensory and imaginative immersion, and slight to moderate levels of other experiences. However, some differences between Spanish and English speaking samples are found regarding negative experiences. Although students in both samples experience similar levels of tension, Spanish students have somewhat higher levels of negative affects (they felt more bored and tiresome).

Results showed that different aspects of game experience are relevant for some dependent variables. Students who experienced deeper immersion during playing School of Empathy game had higher compassion for the victim, higher empathy, better social skills and higher intention to help the victim in the post-test. Students who experienced higher tension reported more frequent victimization and aggressive reactions, while students who had lower tension perceived higher self-efficacy in protecting the victim. In addition, students who felt that they were competent while playing the game, reported more assertive reactions after gaming sessions. Overall, results suggest that players' game experience determined the effects of School of Empathy game on different outcomes. Our results stress the immersion as an important aspect of game experience, necessary for behavioural change. There still exists insufficient research that explore impact of immersive experience in the process of gaming on learning outcomes (Cheng, She, & Annetta, 2015; Hamari et al., 2016). However, Cheng et al. (2015) found that immersion had a positive impact on learning outcomes and game immersion experience did lead to higher gaming performance.

Regarding game quality, the highest scores were obtained for clarity of instructions and readability of fonts in both samples, but students also frequently reported that the game stopped unexpectedly.

The students reported that the School of Empathy game moderately contributed to their knowledge of bullying but also to improving knowledge about safe use of internet to some extent. However, students' perception of the effect the game playing on their knowledge only partially reflect their actual knowledge.

Students who played School of Empathy game had similar number of positive and negative comments about the game. According to the qualitative analysis of their statements the positive aspect most mentioned refers to the students' fun followed by the category emotional aspects and motivation. The students declare to be motivated when they solve the different phases of the game, which encourages them to continue, especially to put themselves in the victim's place, and to feel like her.

Regarding the drawbacks, the difficulty that students mention most often is monotonous play. The students consider that the game is quite repetitive, especially at the beginning, which produces boredom and fatigue in them. Related to this aspect the students mention the category design of the game, in general they consider that the game presents / displays several failures and errors, mainly, related to the time of reaction of the personages, which causes that they move more slowly and that their answer be later.

5.3. "SCHOOL OF EMPATHY" GAME METRICS

5.3.1. RELATION BETWEEN TARGET VARIABLES AND GAME METRICS

Knowledge about bullying and appropriate reaction was not predicted by students' in-game behaviour.

Among variables from Theory of planned behaviour only perceived control and self-efficacy in protecting the victim were predicted by students' in-game behaviours. Namely, students who participated in dialogs in the bystander and bully role more often showed higher perceived control in protecting the victim after playing School of Empathy game. Also, higher achieved level in tower building mini game in the victim role was related to higher level of control in protecting the victim. Perceived self-efficacy was predicted by frequency of participation in dialogs in victim and bystander role as well as by total frequency of participation in dialogs. Students who participated in more dialogs showed higher self-efficacy in protecting the victim.

Among personal variables, only assertive and aggressive reactions in everyday situations were predicted by students' in-game behaviours. Students who participated in more bystander dialogs and who identified appropriate reactions in bullying situations reported more assertive behaviour in everyday situations in the post-test. Students who participated

in more dialogs especially in bystander role and who correctly identified bullying and appropriate reactions in those situations while playing School of Empathy game, reported less aggressive behaviour in everyday situations in the post-test. These results imply the transfer of obtained knowledge and behaviour from the game to real life situations and may be an indicator of game efficiency in behaviour change.

5.3.2. RELATION BETWEEN GAME METRICS WITH GAME EXPERIENCE AND QUALITY

Students' experiences during playing School of Empathy game and their perception of game quality were related to game metrics i.e. to the students' behaviours during game play. Feeling of competence and perceptions of learnability showed the strongest relation to in-game data.

Regarding students' experiences, feeling of competence, affects and challenge were related to students' in-game behaviour. Feeling of competence was positively related to both frequency of participation in dialogs in different roles (victim, bully, and bystander) and frequency of playing mini games in the bully role, as well as by level achieved in all mini games in all roles. The students who participated more often in game activities, and who achieved higher levels in mini games felt more successful in playing the game. Students who played the guitar game in the victim role more frequently experienced more negative and less positive affects. Students who participated in dialogs in the bully role and in all dialogs more often felt less challenged i.e. thought that the game was not so hard. These results indicate that the feeling of competence was affected by all activities in the game, including dialogs and playing mini-games. However, mini-games were relevant for affective aspects of game experience.

Regarding game quality, game satisfaction was related only to level achieved in guitar mini game in the victim role. Students who achieved higher level in the mini game were more satisfied with the School of Empathy game. Higher learnability (i.e. perceived clarity of game's fonts, and usefulness of instructions and feedback) was related to more frequent participation in different dialogs (victim, bystander, total) and in football mini game, as well as with achieved higher levels in mini games.

5.5. CONCLUSIONS REGARDING THE “SCHOOL OF EMPATHY” GAME

Initial comparison of pre and post-test data for all dependent variables in three conditions (School of Empathy condition, Go Online condition and Control condition) did not show positive impact of playing School of Empathy game on knowledge and behaviour in bullying situations, attitudes toward bullying and protecting the victim, perceived control, self-efficacy, subjective norms and behavioural intentions in protecting the victim, as well as on students assertiveness, empathy, compassion for victim, social skills, and friendship.

Students who played School of Empathy game recognized improvement in their knowledge regarding bullying situations, but they were not highly accurate in judgments of their learning. However, their self-assessments of improvement in knowledge and behaviour was not related to reported experience of victimization and bullying behaviour.

One important issue should be pointed out. The results in both samples (Spanish and English speaking) showed that students before playing game, in general, had good knowledge about the bullying and the cases of bullying were exceptional. There are several possible reasons for that. The call for participating in the research was open for all schools, but only schools that were interested applied. It is possible that schools with high awareness about bullying applied since they reported about various projects to prevent bullying that have been implemented in their schools for some years. Furthermore, parental and student consents are prerequisite for research and this may lead to biased sample (e.g. violent child would refuse to participate). Therefore, the room for improvement in knowledge and behaviour in bullying situations was quite small.

Regarding the lack of effect on personal characteristics, especially empathy and assertiveness, the context of applying the game should be considered. Namely, the intervention effects on these characteristics might be more prominent in synergy of different intervention modes like in whole school approach (e.g. KiVa program, Kärnä et al., 2013). It seems that the effects of the game could be more salient if the game playing was embedded in broader bullying prevention program and discussed with children. Since the main aim of the e-Confidence project was the validation of an experimental methodology for the design and evaluation of serious game mechanics, the game was applied and validated as stand-alone intervention.

Although the comparison of pre and post-test data did not show the positive effect of the School of Empathy game on target dependent variables, further specific analysis showed that students who improved the knowledge of assertive as appropriate reactions in bullying

situations after playing the School of Empathy game, also showed improvements in some other characteristics. They improved in recognizing bullying situations, showed more negative attitudes toward bullying and more positive attitudes toward protecting the victim and behavioural intention to help the victim, as well as more assertive reactions in general.

Analysis of the contribution of students' game experience in addition to general student characteristic (age and gender) and initial results, in explanation of all analysed outcome, gave additional insights in game functioning and showed some important positive effects. Older students reported higher level of compassion for victim, more assertive reactions and less aggressive reactions in everyday situations. This result is expected as an effect of socio-emotional maturation. Also, different aspects of game experience were relevant for some outcomes. Students who experienced deeper immersion during playing School of Empathy game had higher compassion for the victim, higher empathy, better social skills and higher intention to help the victim in the post-test. Students who experienced higher tension while playing the game reported more victimization experiences and more aggressive reactions in everyday situations, while experiencing lower tension was related to higher self-efficacy in protecting the victim. Furthermore, students who felt that they were competent while playing the game, reported more assertive reactions in everyday situations.

Overall, results suggest that in analysing the effects of School of Empathy game on different outcomes, we should consider players' game experience. As results of previous studies (e.g. Cheng et al., 2015), our results also stress the immersion and perceived competence during game playing as important aspects of game experience necessary for behavioural change. The insight from students' commentaries reveals that game was in some parts repetitive and frustrating, but some students found game fun and entertaining. Therefore, it is very important that game places an optimal challenge for students i.e. the challenge should closely matches students' abilities in order for them to feel competent.

Analysis of in-game metrics revealed that there was a great variability in frequency of participation in dialogs in different roles (victim, bystander and bully). More than 30% of students did not participate in bystander and bully dialogs, nor in bully mini games (about 40%). In order to enable students to reach bystander and bully roles, the game should be modified in a way that students can more easily pass victim role.

The analyses of in-game data that were recorded during playing sessions showed that in-game behaviour of players had effects on some outcomes. Although recognizing bullying situations was not predicted by behaviour displayed during playing School of Empathy game, achieved higher level in one mini game (football) in the victim role improved their knowledge about appropriate reactions in bullying situations after playing sessions. Among

variables from Theory of planned behaviour only perceived control and self-efficacy in protecting the victim were predicted by students' in-game behaviours. Students who more frequently participated in dialogs in different roles, showed higher perceived control and self-efficacy in protecting the victim after playing School of Empathy game. Among personal variables, only assertive and especially aggressive reactions in everyday situations were predicted by students' in-game behaviours. Students who more frequently participated in dialogs primarily in bystander role, reported more assertive and less aggressive reactions in everyday situations in the post-test. Therefore, the game could be improved by adding more situations in bystander role in order to obtain behaviour change.

The Big Data analysis of School of Empathy has also found some relations between test results and in game behaviour. Overall, these relations are small but in three cases it can be considered strong enough to delve the data. Answers in pre-test regarding attitude towards protecting the victim are related with the selection of some specific type of answers. The improvements in empathy and in social skills are also related with the selection of some specific type of answers having specific dialogue answers associated with social interactions. These results also point to conclusion that game dialogs are related to some target variables and should be further elaborated.

Students' experiences during playing School of Empathy game and their perception of game quality were also related to game metrics i.e. to the students' behaviours during game play. Feeling of competence showed the strongest relation to in-game data. The students who participated more often in game activities, and who achieved higher levels in mini games felt more successful in playing the game. Playing mini games was related to affective reactions, and participating in dialogs was related to challenge.

Regarding game quality, it was found that students who participated more frequently in different dialogs (victim, bystander, total) and in football mini game assessed higher learnability, i.e. they perceived the game's fonts, instructions, feedback and more clear and useful. They also achieved higher levels in all three mini games in the victim role and in the football mini game in the bully role. Furthermore, students who achieved higher level in the guitar mini game in victim role were more satisfied with the School of Empathy game and those who did not improve were less satisfied. The objective of the Guitar Hero mini game was to induce feelings that the victim of bullying might feel. In the beginning players were able to complete only few levels of the game regardless how much they try and most of the students felt angry, upset and frustrated that resulted with lower satisfaction. However, the empathy was not induced since almost 80% of students thought that victimized students do not have similar feelings in real life situations. That also might explain the lack of relation of

Guitar hero mini game with target variables such as empathy and compassion. Therefore, it should be stressed again that it is very important that game places an optimal challenge for students and enables their immersion during game playing.

In summary, as school bullying and peer victimization are major social problems affecting children and adolescents in all parts of the world, serious games have potential to become an effective tool for bullying prevention since children prefer gaming activities over traditional ways of learning.



6. EVALUATION OF eCONFIDENCE METHODOLOGY AND RECOMMANDATIONS

The initially proposed methodology was a modified version of ATMSG (Carvalho et al., 2015) in which we include including the behavioural part taking into account the ABA methodologies. In this way, we use a methodology that helps us to design the game and to assess the educational and, with the new components, also the behavioural charge of the games.

The way we planned to do it was including a new activity, the “Behaviour Activity”, that will be treated in a similar way that the other three activities (Gaming, Learning and Instructional) that are already defined in the ATMSG methodology. The tool will be related to all the activities as the connexion point. We depicted the methodology in Figure 1. and we call it ATMSG-B.

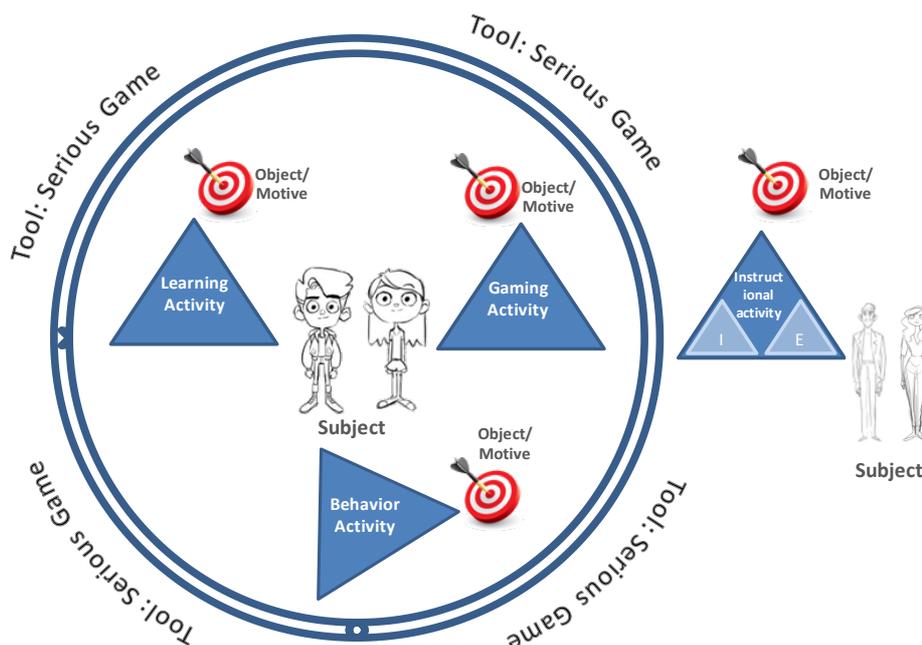


Figure 1. - ATMSG-B proposed diagram.

To include the ABA components, we created a new taxonomy related to the behavioural change, so we can mimic the original methodology. This is really useful in order to unify vocabulary; it used to be a common problem in this case: the psychologies and the game

designers do not share the same vocabulary. The taxonomy was created according to Ferster and Skinner (1957), Cooper, Heron, and Heward (2007) and Linehan, Kirman, and Roche (2015). It is divided in Actions Tools and Goals in order to fit into the diagrams.

- Behavioural Actions: present problem, explore, decide, virtual conversation, discuss, rewarding decisions, quantitative assessing performance, feel, understand, feel another situation, choose actions, prompting,
- Behavioural Tools: information, story, behaviour reinforcement, punishment, shaping, chaining, intermittent reinforcement variable ratio, visual prompting, gestural prompting, monitoring, punishment,
- Behavioural Goals: define target behaviour, behaviour change, generalization.

We keep the UML style representation of the game and we enlarge the diagrams of the methodology to include the new activity. For each of the components on the UML description of the game the game designers have to define, if exist, the behavioural activity including the action, the tools and the goals. Figure 2 shows part of the School of Empathy game diagrams and related information.



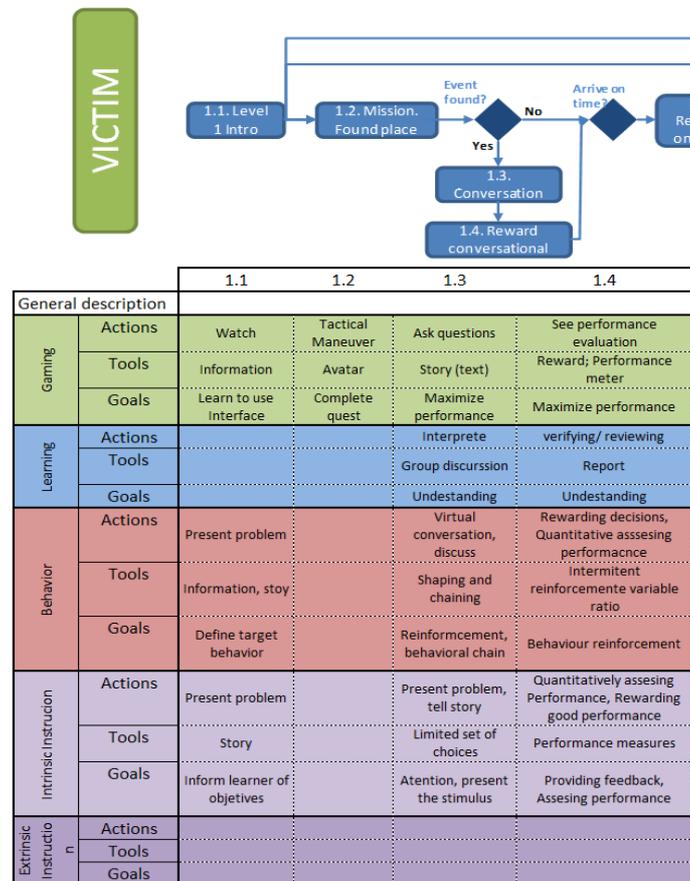


Figure 2. - ATMSG-B diagram example

Although the diagrams for both games were created, it was almost impossible for the development teams to use it to design the game. It will be really complex to start a game design with the learning or behavioural charge that generate a UML diagram which finally creates a storyboard of the game. The only way that both teams found to use this first proposed methodology was to apply it to assess the learning and behavioural charge of the game and where it was applied. Nevertheless, even this part was a bit challenging because the design and games are big and complex as the games have to tackle a complex problem. ATMSG was usually used in quite simple games, but in our case, some of the games have more than 40 UML components that are candidates for which the 12 sections could be completed (or 15 if we consider also the extrinsic instructional activity).

Finally, this approach was discarded by the consortium because it was not useful for the real design of a serious game that includes the learning and the behavioural aspects in a fun way. Taking all this into account we decided to create a full new methodology including all the useful tools and workflow that we use during the project and also including all the improvements that we foresee to be really beneficial to create games aimed at change

behaviour. Some of them are also based on the final results of the project, that show that the parts of the games where the ABA methodology was included appear to be more efficient to change behaviour.

The final methodology “Behaviour Change through IMP and ABA techniques” (BCIA) is built on two well-known methodologies in psychology: the Intervention Mapping Protocol (IMP, Bartholomew, Parcel & Kok, 1998) and the already mentioned ABA, integrated in one comprehensive methodology consisting of 6 steps from the way the problem to tackle is selected, over the psychological analysis of the behaviour, to the final assessment. A key aspect is that behaviour is included from the very beginning of the game development process, involving experts such as psychologists. Additionally, it assigns responsibilities and assesses the validity of the output, the latter another essential aspect to cover, in order to create an effective Serious Game. The methodology of eConfidence games development builds on two well-known methodologies in psychology: the Intervention Mapping Protocol (IMP, Bartholomew, Parcel, & Kok, 1998) and the Applied Behaviour Analysis (ABA, Bear, Wolf, and Risely, 1968), integrated in an comprehensive methodology consisting of steps from the way the problem to tackle is selected, over the psychological analysis of the behaviour, to the final assessment. A key aspect is that behaviour is included from the very beginning of the game development process, involving experts such as psychologists. Additionally, it assigns responsibilities and assesses the validity of the output, the latter another essential aspect to cover, in order to create an effective Serious Game.

The main novelty of this methodology is that it is focused on the behavioural aspects integrated in the games. Other Serious Games or projects, like Friendly Attac (DeSmet et al., 2018) or initiatives for sexual health (Brown, Bayley, & Newby, 2013), have applied some psychological techniques, but not based on a methodology of game design that integrates psychological and game developers inputs. It is noted that for other types of serious games some methodologies do exist, like HABS (Marsh, Yang, & Shahabi, 2006), RETAIN (Gunter, Kenny, & Vick, 2006), GOMII (Amory, 2007), or MDA (Hunicke, LeBlanc, & Zubek, 2004), only to mention some of them.

Obviously, the methodology by no means removes any creativity that must exist in the creation of any serious game - following the rules to create a Cubist style painting is no guarantee for a good painting! Game designers are totally free to apply any creative practice while covering the topics as defined by the psychologists in the team. What the BCIA methodology focuses on is the correct exchange of documentation, on validations by psychologists and game designers, and on the assessment of the behavioural change. Templates for the psychologists and game developers, and practical examples of how to

translate the generated information into game dynamics are provided along with the methodology. These examples can be seen as the classic post-mortem of a game, however focused on how to design and implement new games for Behaviour Change.

It is also recommended to include detailed metrics of each of the relevant actions of the player within the game, as it will give really valuable information in the final assessment of what parts of the game were played. In some cases, we found no behaviour change in the assessment, but we were able to see that the user kept on playing only a small part of the full game during all the experimental phase.

In the two games developed during the eConfidence project, the methodology was proven promising as the scientific analysis of the recorded data showed indications of some improvement in bullying and online behaviour. Additionally, it turned out very practical to follow the steps of workflow.



7. CONCLUSIONS

Evaluation of the eConfidence games was done comparing group of students who played game with group that received no intervention, and a group with different type of intervention (playing different game). That is in line with recommendation based on meta-analysis of effectiveness of serious games (Girard, Ecalle, and Magnant, 2013) because conclusions based only on comparison between pre and post data could be misleading, as changes observed in experimental group might not be related to game itself but to some other factors that also lead to change in control group. This was obtained in our research i.e. changes obtained in experimental group were also obtained in control groups.

The general finding of the eConfidence pilot study was that the improvement in knowledge and behaviour, as well as in other measured personal variables, as a consequence of playing eConfidence games were not obtained. However, it should be pointed out that initial knowledge about addressed two topics (safe use of internet and bullying) in both samples (Spanish and English speaking) was excellent and students' target social behaviours were appropriate, leaving little room for improvement. When the students have less knowledge about the topic, there have been some indications that the gaming activity could be effective for knowledge improvement. In sum, for a game to be efficient in changing students' knowledge and behaviour it should be tailored according to students' previous knowledge and behaviour, or the game should be applied to students with insufficient knowledge and inadequate behaviour.

Regarding the lack of effect on personal characteristics, especially empathy and assertiveness, the context of applying the game should be considered. Previous studies show that serious games as an educational tool and intervention for behavioural change could be more effective when integrated in broader school based programme and discussed with children.

However, additional analyses of in-game metrics of eConfidence games showed that different game components could have contributed to relevant outcomes even when the game was applied as stand-alone intervention. Namely, in the School of Empathy game the dialogs were related to behaviour improvement, while in Go Online game learning was evident during playing mini-games. Also, it seems that for effectiveness of the game it is more important to consider the duration of activity and engagement in specific game tasks that have an impact on target outcomes instead of taking into account total game duration.



In conclusion, in-game metrics should be considered in evaluation of game effectiveness in addition to pre- and post-assessment.

The results of eConfidence study also stress the importance of players' game experience in obtaining beneficial outcomes of the game. Our analysis showed that the immersion in the game and perceived competence during game playing can bring about positive psychological outcomes. The insights from students' commentaries revealed that games were in some parts repetitive and boring, but some students found games fun and entertaining. Therefore, dynamic tailoring based on the difficulty level the player can master (e.g. via providing hints when the challenge is too hard) could provide all players with an optimal level of challenge. On the other hand, children are accustomed to dynamic games with high graphic quality and therefore serious games should find good balance between fun and education.

The main novelty of the eConfidence methodology in developing serious games is that it is focused on the behavioural aspects integrated in the games. It builds on two well-known methodologies in psychology, the Intervention Mapping Protocol and the Applied Behaviour Analysis, and consists of steps from problem selection, over the psychological analysis of the behaviour, to the game evaluation. This methodology gives opportunity to broaden serious games application in education. Namely, serious games have been applied in education for a long time with good outcomes in different educational programs and schools (Boyle et al., 2016), but they were focused mainly on teaching. However, serious games have not so frequently been used for promoting good behaviour and correcting undesirable behaviour. The eConfidence methodology now helps the serious gaming sector to create effective games promoting behavioural change.

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