

Université de Montréal

ZeroAbuse, a serious game to prevent child maltreatment.

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Ce mémoire intitulé

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Résumé

La maltraitance des enfants est un problème critique qui touche environ un milliard d'enfants dans le monde chaque année. Les blessures qui persistent toute leur vie, les handicaps ou même la mort sont des conséquences risquées découlant de la maltraitance des enfants. Plusieurs approches, y compris les *Jeux Sérieux* (SGs), ont été conçues pour éduquer les individus sur la maltraitance des enfants et comment la prévenir. Cependant, les SGs qui sont présentement en existence se concentrent uniquement sur l'intimidation ou les abus sexuels chez les enfants et non sur toutes les formes possibles de maltraitance des enfants. De plus, la plupart des ressources concernant la prévention de la maltraitance des enfants s'adressent aux adultes et non aux enfants. Ce travail se concentre sur la conception d'un SG appelé *ZeroAbuse* qui englobe les quatre types de maltraitance des enfants: *Physique, Émotionnel, Abus Sexuel et Négligence*. Il combine les principes d'apprentissage, les éléments pour immerger le joueur dans le jeu et les critères de qualité des programmes de prévention. *ZeroAbuse* s'adresse aux enfants âgés de 9 à 11 ans, qui sont exposés de manière homogène à tous les types de maltraitance. Il tient également compte des compétences cognitives et physiques propres aux enfants de cet âge. La conception du SG a pris en compte les perspectives d'experts en prévention de la maltraitance des enfants et a été testée sur la population cible afin d'améliorer l'expérience de jeu et valider l'approche d'apprentissage.

Mots-clés : Apprentissage par le jeu, Jeux Sérieux, Maltraitance des enfants, Prévention de la maltraitance des enfants.

Abstract

Child abuse is a critical problem affecting approximately one billion children worldwide annually. Lifelong injuries, disabilities, or even fatalities are risky consequences derived from child abuse. Several approaches, including *Serious Games* (SGs), have been designed to educate individuals about child abuse and how to prevent it. However, existing SGs focus only on bullying or sexual abuse and not all possible forms of child abuse. In addition, most of the existing resources for child abuse prevention are aimed at adults and not at children. This work focuses on designing an SG called *ZeroAbuse* that encompasses the four types of child abuse: *Physical, Emotional, Sexual abuse* and *Neglect*. It combines the principles of learning, the elements to immerse the player into the game, and the quality criteria of prevention programs. *ZeroAbuse* is aimed at children aged 9 to 11 years, given that they show homogeneous participation in all types of abuse. It also considers the cognitive and physical competencies of children at this age. The SG design considers the perspectives of experts in child abuse prevention and was tested on the target population to enhance the game experience and validate the learning approach.

Keywords: Game-based learning, Serious Games, Child abuse, Child abuse prevention.

Contents

Résumé.....	1
Abstract.....	2
Contents.....	3
List of Tables	5
List of Figures	6
List of Abbreviations	7
Acknowledgments.....	9
Chapter 1. Introduction	10
1.1 Problem Definition and Motivation	10
1.2 Research Objectives and Main Contributions.....	13
1.3 Thesis Organization	14
Chapter 2. Background and Literature Review.....	15
2.1 Game-Based Learning – Serious Games.....	15
2.2 Child Maltreatment.....	17
2.3 Child Abuse Prevention Programs.....	20
2.4. Serious Game to Prevent Child Abuse	22
2.5 Comparison of Serious Games in Child Abuse.	24
Chapter 3. The Design of the Serious Game	30
3.1 ZeroAbuse - Serious Game	30
3.1.1 General and Specific Learning Objectives	30
3.1.2 Model Definition.....	31
3.2 Course Design.....	33

3.2.1 Analysis of the Target Audience	33
3.2.2 Content Design	33
3.3 Components of ZeroAbuse.....	46
3.3.1 Knowledge Component	47
3.3.2 Learning Component	49
3.3.3 Game Mechanism.....	52
3.3.4 Administrator Module	53
Chapter 4. Implementation	55
Chapter 5. Evaluation.....	64
5.1 Evaluation of ZeroAbuse’s Components	64
5.1.1 Evaluation of The Game Part.....	65
5.1.2 Evaluation of The Serious Part	67
5.2 Evaluation of ZeroAbuse’s Effectiveness	73
Chapter 6. Conclusion and Future Work	76
References	77
Appendix	89
Appendix A: Instrument to determine the level of knowledge by type of abuse.....	89
Appendix B: Instrument of measurement to evaluate the serious part.	90
Appendix C: Instrument of measurement to evaluate the effectiveness and attractiveness of ZeroAbuse.	93

List of Tables

Table 1.- Types of child abuse and definition.....	18
Table 2.- Criteria and aspects for Serious games	26
Table 3.- Criteria to evaluate SGs for child abuse prevention.....	27
Table 4.- The evaluation results for a SG aimed at reducing child abuse	28
Table 5.- General and specific learning objectives of ZeroAbuse	30
Table 6.- Examples of abusive behaviors.	34
Table 7.- Relevant facts in child maltreatment	35
Table 8.- Cases by type of abuse in the Serious Game	49
Table 9.- Thinking skills related to learning and game mechanisms designed in ZeroAbuse.....	51
Table 10.- Quality criteria to evaluate the game part.....	66
Table 11.- Results of the evaluation of the game part.....	67
Table 12.- Quality aspects for the serious part.....	68
Table 13.- Results of the evaluation of the serious part – Organization I.....	70
Table 14.- Score - Organization I	71
Table 15.- Result of the evaluation of the serious part – Organization II	72
Table 16.- Score - Organization II	73

List of Figures

Figure 1.- Primary category of maltreatment in Canada in 2019 for First Nations and Non-Indigenous Children.	19
Figure 2.- Child age by primary category of substantiated maltreatment, in Canada in 2019.....	19
Figure 3.- Development process of ZeroAbuse.....	32
Figure 4.- Guidelines of domain experts.....	37
Figure 5.- Example of extraction of subtopics	38
Figure 6.- Definition of abuse extracted and rephrased in children’s language.	39
Figure 7.- Support systems.....	40
Figure 8.- Laws related to neglect rephrased to children’s language	41
Figure 9.- Extraction of the characteristics, behavior, and emotions of the individuals involved and the scenarios.	42
Figure 10.- A sexual abuse sketch	43
Figure 11.- A fragment of the case for sexual abuse	45
Figure 12.- Example of reinforcement activity.....	46
Figure 13.- Principal components of the Serious Game	47
Figure 14.- Topics in ZeroAbuse	48
Figure 15.- The flow for each level of the Serious Game.....	50
Figure 16.- Flowchart of the Serious Game	55
Figure 17.- The menu of Tutor Module.....	56
Figure 18.- Levels and scenes of ZeroAbuse	58
Figure 19.- Learning strategies implemented in the Serious Game	59
Figure 20.- Rewards implemented.....	60
Figure 21.- The Serious Game Menu	61
Figure 22.- Examples of feedback implemented in the Serious Game.....	62
Figure 23.- The evaluation process	65

List of Abbreviations

UNICEF: United Nations Children's Fund

SGs: Serious Games

GBL: Game-Based Learning

ADHD: Attention Deficit Hyperactivity Disorder

SGBV: Sexual and Gender-Based Violence

PD: Participatory Design

CSA: Child Sexual Abuse

GX: Game Experiences

VR: Virtual Reality

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Chapter 1. Introduction

This section defines the problem we address and the motivation to develop this work. It also introduces the research objectives, the main contribution and the structure of this thesis.

1.1 Problem Definition and Motivation

Child abuse, a real and severe health and social problem, affects one billion children worldwide annually (World Health Organization, 2020). Several strategies have been developed to reduce the impact of child abuse. This work focuses on and proposes a *Game-based learning* (GBL) tool - *Serious Games* (SGs)- as part of the strategies to help prevent child abuse cases. To this aim, it is necessary to first describe the negative impacts of child abuse to help understand the motivation of this work.

The Department of Justice Canada defines "Child Abuse" as the violence, mistreatment, or neglect that a child or adolescent may experience while in the care of someone they either trust or depend on, such as a parent, sibling, another relative, caregiver, or guardian (Department of Justice Canada, 2005). Child abuse is classified into four main categories: sexual abuse, physical abuse, emotional abuse, and neglect (Department of Justice Canada, 2005; Macdonald *et al.*, 2016). Sex talking, hitting with an object, threatening, and failing to provide medical care are examples for each classification (National Clearinghouse on Family Violence Canada, 2006). Despite its high negative impact on our society, many cases remain invisible and unpunished (Burczycka *et al.*, 2017).

The violence suffered by children may result in death, injuries, or disabilities, and its potential health consequences can remain throughout their entire life (Canadian Resource Centre for Victims of Crime, 2022; Fortson *et al.*, 2016; UN World Health Organization (WHO), 2016). Regarding the economic cost, a global estimation is not available, but we can have a general idea by considering the cost in some regions, such as the United States of America (US) and East Asia Pacific. The estimated lifetime cost of child maltreatment occurring in one year, based on 2015 substantiated incident cases, was \$428 billion in the US (Peterson *et al.*, 2018). Meanwhile, this

cost in the Asia-Pacific region is around \$209 billion, according to United Nations Children's Fund (UNICEF) estimations in 2015.

In Canada, 32% of Canadians older than 18 have experienced physical, sexual, or emotional abuse when they were children (Public Health Agency of Canada, 2019). Also, the number of maltreatment-related investigations for indigenous and non-indigenous children in 2019 ascends to 299,217 (Fallon *et al.*, 2021) and the economic costs of child abuse to \$15.7 billion per year (Early Childhood Observatory, 2017).

Failing to prevent child abuse can produce undesirable situations, such as in the case of Gabriel Fernandez, who not knowing whom to ask for help, asked his teacher if it was acceptable for parents to beat their children. Eventually, Children's Hospital Los Angeles confirmed Gabriel Fernandez's death after being beaten by his mother and stepfather. His body showed injuries and burns. His innocence and the lack of education about child abuse did not allow him to see that the mistreatment he received was unacceptable (Gajanan, 2020; Goff, 2014; Lowry, 2020).

The Government of Canada has designed strategies and campaigns to reduce the impact of child abuse (Fortson *et al.*, 2016; Government of Canada, 2001; Public Health Agency of Canada, 2019). The strategies encompass public education programs and child-sensitive protocols to prevent future abuse of children (Department of Justice Canada, 2005; Public Health Agency of Canada, 2019). Some resources to educate about abuse supported by the Government utilize *Game-Based Learning* (GBL) as an educational method (Canadian Centre for Child Protection Inc., 2017).

GBL is an active learning method that uses a game framework that supports learning and teaching (Egenfeldt-Nielsen, 2005; Van Eck, 2006). *Serious Games* (SGs) has been developed as a product in which GBL is achievable. Serious Games are created to entertain and to achieve at least one additional goal (Caserman *et al.*, 2020; Dörner *et al.*, 2016). They have a great reception because they involve a learning process similar to the natural human learning process, that is, by experimenting and modifying what has been learned according to new experiences (Gee, 2008).

Serious Games are tools used in educational, social and scientific areas (Boyle *et al.*, 2016; Connolly, 2012; Serious Game Society, 2022). Education programs for prevention include SGs, because of their benefits. They allow students to learn by exploring simulated scenarios that

mimic imaginary or real situations that can be costly or unsafe to experience in real life (Corti, 2006; de Freitas, 2006).

The current SGs addressed to prevent child abuse seek to tackle sexual abuse and bullying, leaving out other types of abuse (Asadzadeh *et al.*, 2022; Calvo-Morata *et al.*, 2020). It is worth mentioning that other types of abuse have a significant contribution to the number of child abuse cases reported in Canada. For example, Physical Abuse appears in 16% and Neglect in 28% of cases (Fallon *et al.*, 2022). In addition, several types of abusive behavior require attention and preventative measures (Canadian Resource Centre for Victims of Crime, 2022). SGs, through some game elements, can evoke different thinking skills that are not being currently exploited (Carvalho, 2017; de Freitas, 2006) or do not adequately fit the target audience of our work (Nilsson *et al.*, 2020).

The highly notable impact of child abuse in society and the lack of SGs focused on the four types of abuse motivate the design of a SG aimed at children, as supported by:

- Child abuse and Neglect can be prevented, and preventing this problem can prevent other forms of violence (Fortson *et al.*, 2016; UN World Health Organization (WHO), 2016).
- Educating people is our best defense against abuse, and the evidence indicates that children without the knowledge of prevention are twice as likely to be victims of abuse (Gibson & Leitenberg, 2000). Children who had participated in prevention programs were seven times more likely to adopt a protective behavior than those who did not (Finkelhor, 2023).
- SGs enrich the teaching process by engaging students in the content they want them to learn (Arnab *et al.*, 2013; Carvalho, 2017; Jones *et al.*, 2020)

Therefore, given the above-mentioned problems and the advantages of SG, the following research questions are addressed in this thesis.

- How to design a curriculum that incorporates a dynamic strategy that lets children achieve the learning objectives and engage them, considering the different types of learning and

the characteristics and competencies of the target group, as well as the extensive and sensitive subject.

- How to design and implement an effective SG to teach children to recognize different situations of abuse, that let them know if they are living situations of abuse and internalize what are unacceptable behaviors.

1.2 Research Objectives and Main Contributions

There are serious games designed to focus on sexual abuse prevention and bullying. However, other types of abuse need to be addressed. Also, we need serious games that combine the curriculum and the expectations of children, considering their culture, idiosyncrasies and development. The authors in Fallon *et al.* (2022) reveal that children aged 9 to 11 years old are equally likely to experience all types of child abuse. However, as stated before, the existing resources only focus on some kinds of abuse. Thus, this work focuses on providing a resource to overcome this issue. It is worth mentioning that some definitions of abusive behavior use terms that are unknown to young children (Blumenthal, 2015). Therefore, based on the above-mentioned, the contributions and objectives of this thesis are as follows:

- Develop a curriculum to prevent child abuse addressed to children that includes physical, emotional, sexual abuse and neglect, combining guidelines of prevention programmes that cover the types of learning.
 - Include to know what sexual, physical, emotional abuse and neglect are, to recognize several ways these types of abuse manifest, to respond appropriately to unsafe situations and to increase the sense of empathy.
- Design and implement a Serious Game to educate children from 9 to 11 years old about child abuse, to reduce child victimization through dynamic interaction based on game experience elements.
 - Include quality criteria to design SG to archive the characterizing goals (effective) and to immerse the player in the game (attractive), considering children's cognitive and physical competencies. The criteria are defined principally by Caserman *et al.* (2020), Nilsson *et al.* (2020), and Sweetser & Wyeth (2005).

- Incorporate game experience elements, learning methods and strategies according to the characteristics of middle childhood that evoke different levels of thinking skills, such as problem-based and learning by disturbing, and other elements of gamification based on developmental competencies.

1.3 Thesis Organization

The remainder of this thesis is organized as follows:

- Chapter 2 provides a context on Game-based learning, child abuse, and child abuse prevention programs. It also overviews the tools created to prevent child abuse, particularly Serious Game (SG), and the criteria utilized to evaluate the current SGs.
- Chapter 3 describes the methodology and processes for developing the proposed SG, along with the corresponding curriculum designed to cover child abuse aimed at children.
- Chapter 4 explains the implementation of the serious game.
- Chapter 5 summarizes the findings obtained in the evaluation stage and the results of measuring the game's effectiveness and attractiveness.
- Finally, Chapter 6 concludes with insights and future directions.

Chapter 2. Background and Literature Review

This section reviews the existing literature on Game-based learning and Child Maltreatment prevention strategies. It provides a general overview of Child Maltreatment and explores the existing programs created for child abuse prevention and current learning tools designed for this purpose. Also, this section discusses the effectiveness of Game-based learning (GBL), and presents and evaluates serious games focused on abuse. Finally, the section concludes by outlining the contributions of the proposed Serious Game.

2.1 Game-Based Learning – Serious Games

Technological advances demand changes in teaching and propose the use of games to support learning and teaching (Egenfeldt-Nielsen, 2005; Michael, 2006; Van Eck, 2006). Game-based learning (GBL) is an active learning method that uses a game framework (Carvalho, 2017; Heidmann, 2015; Suttie *et al.*, 2012). It enables the combination of various learning styles in one application and the transmission of the curriculum to groups of students with different profiles, abilities and learning styles (de Freitas, 2006). According to the findings, game-based learning had a notable and favorable impact on the critical thinking capabilities of students (Mao *et al.*, 2022). Among the variety of GBL, there is Serious Game (SG). Sometimes, the terms serious game and GBL are used interchangeably (Corti, 2006). SGs evolved as good platforms that combine different teaching methods, strategies and techniques, and pedagogic approaches, increasing the learning processes (de Freitas, 2006; Suttie *et al.*, 2012; Van Eck, 2006). The SG focuses on learning context or training objectives. It relies on doing and learning by experience rather than listening, which engages the students and helps them retain knowledge (de Freitas, 2006; Gee, 2008; Jenkins, 2009). According to Zhonggen (2019), the use of serious games in education has been found to have numerous benefits. These include enhancing learners' overall comprehension of scientific concepts, improving the retention of scientific knowledge, boosting cognitive abilities, and promoting a positive attitude towards learning.

SG has been used in different disciplines (Boyle *et al.*, 2016; Connolly, 2012; Corti, 2006; Serious Game Society, 2022). In health care, SGs have a high contribution as compared with other fields

(Boyle *et al.*, 2016; Connolly, 2012). The topics covered therein are rehabilitation, quality of life, life supporting, and other extra-curricular learning contexts such as substance abuse and healthy eating (Boyle *et al.*, 2016). In education, SGs have been effective in numeric and non-numeric subjects, such as language, mathematics and engineering and computing (Chen & Yang, 2012; Nte & Stephens, 2008; Papastergiou, 2009; Wijers, Jonker & Kerstens, 2008). In security, SGs have been utilized to train individuals on topics that require simulating risky situations or preparing them to handle dangerous tasks (Oliveira *et al.*, 2012; Yusri, 2020). For a more complete overview on Serious Games, readers may refer to (Boyle *et al.*, 2016).

In the case of a child audience, SGs are widely used in several areas such as safety, social, health, and educational fields. Regarding safety, there are serious game simulations to prevent childhood injuries by identifying home hazards (see Wright *et al.*, 2021). The authors in Wright *et al.* (2021) highlight that SGs allow the practice of skills in a low-impact environment, avoiding distraction, providing flexibility and preventing frustration. The SG in that work, called *Home Safety Hero*, is based on active learning, feedback, attention and consolidation. It uses elements such as sound, music, graphics, constant feedback and storytelling. Regarding social areas, SGs are powerful tools to address social issues and improve behavior in social systems. Also, they have been effective in tackling social problems and social innovation (Gomes *et al.*, 2021). For example, *Water Battle - Saving Water!*, is a serious game that focuses on internalizing water conservation and changing consumption habits (Waterbattle, 2021). In the education field, *Ludwig* is an example of a physics adventure on renewable energy. The game is based on learning by mistake, experimenting and making an effort. Freedom of movement, attractive characters and intriguing storylines prove effective to engage children (Info for Players Ludwig, 2010). Another example is *Minecraft*; the game includes functioning ecology, chemistry and physics aspects, which can serve as a valuable educational tool for children to explore scientific concepts (Ekaputra *et al.*, 2013; Welcome to the Minecraft Official Site, n.d.). There are also SGs that focus on several health issues such as dental, attention and even cancer. For example, in dental care, *Children's doctor: Dentist* lets children simulate being at a real dentist using different tools to treat cavities (Children's Doctor: Dentist. | Yovogames.Com). In attention disorders, *EndeavorRx* is a serious game to treat inattentive or combined-type Attention Deficit Hyperactivity Disorder (ADHD). It aims at improving the

attention and requires a prescription from a healthcare provider to play it (Homepage - EndeavorRx®, 2022). Finally, *Re-Mission* is an example of a game to educate children about the treatment against cancer and it helps children understand how chemotherapy, antibiotics, and the body's natural defenses work (Kayali *et al.*, 2016; Re-Mission, n.d.). However, in the case of child abuse, the number of serious games created to prevent child abuse focused on children is low (Asadzadeh *et al.*, 2022) or they focus on only two forms of abuse (Asadzadeh *et al.*, 2022; Calvo-Morata *et al.*, 2020).

After explaining the benefits and fields in which SGs has been used, the following section discusses child abuse and its impact.

2.2 Child Maltreatment

Globally over half of all children, 1 billion children between 2 and 17 years of age, have been victims of child abuse (Hillis *et al.*, 2016). The Department of Justice Canada defines "Child Abuse" as the violence, mistreatment, or neglect that a child or adolescent may experience under the care of someone they either trust or depend on such as parents, siblings, other relatives, caregivers, or legal guardians (Department of Justice Canada, 2005). It includes sexual, physical, emotional abuse and neglect (Department of Justice Canada, 2005; Macdonald *et al.*, 2016). Family violence prevention resources provide some definitions for each kind of abuse as shown in Table 1. Note that in some provinces, the exposure to domestic violence is considered apart from Emotional maltreatment, while in others it is not (*Canadian Child Welfare Research Portal*, n.d.).

Child abuse is not an unknown term, and everyone has heard about it in their environment or in the news. In the media, some cases are broadcasted given the controversy generated by the inhumanity of the act or due to the profile of the perpetrator. For example, Gabriel Fernandez and Daniel Pelka were victims of physical abuse and were murdered by their parents. Those cases occurred in the USA and England, respectively (Goff, 2014; Holt, 2013). Danielle Crockett, known as the girl in the window, is a case of severe negligence by a parent (Staff, n.d.). Meanwhile, the cases of students at Saint-Laurent Secondary School in Montreal and a student of Brisas Academy Elementary School in Florida are cases of sexual abuse. In these cases, the perpetrators were the

coaches and teachers, respectively, whereas the corresponding victims were women students and a boy student (CBS NEWS, 2018; Zogalis, 2022). Amanda Todd, a teen Canadian, committed suicide after having been victim of cyberbullying and bullying (Dean, 2022). Unfortunately, the list is extensive, but some of these cases have forced governments to evaluate the laws and their systems to protect children (Garrett & Matt, 2022; Rob, 2020).

Table 1.- Types of child abuse and definition

Category	Definition
1. Physical abuse	The application of unreasonable force by an adult to any part of a child's body.
2. Sexual abuse	Involvement of a child, by an adult or youth, in an act of sexual gratification, or exposure of a child to sexual contact, activity or behavior.
3. Neglect	Failure by a parent or caregiver to provide the physical or psychological necessities of life to a child.
4. Emotional harm	Adult behavior that harms a child psychologically, emotionally or spiritually.
5. Exposure to family violence	Circumstances that allow a child to be aware of violence occurring between a caregiver and his/her partner or between other family members.

Reprinted from “*Child Maltreatment in Canada: Overview Paper*”, by Public Health Agency of Canada.

Regarding child maltreatment in Canada, *The Department of Social Development and Health Canada's Canadian Incidence Study of Reported Child Abuse and Neglect* compiles research and statistics to help develop prevention policies and other materials (Government of Canada, 2001). The *Canadian Child Welfare Research Portal* is another website that provides documentation and statistics about this topic. It is important to underline that the statistics and concepts used in this thesis mostly come from these two sources.

In Canada in 2019, there were 299,217 investigations regarding child maltreatment in non-indigenous and indigenous children (Fallon *et al.*, 2021). In Figure 1 the distribution of the kind of abuse in indigenous children is different from the distribution in non-indigenous children. A stark difference is evident when both groups are compared on Physical Abuse and Neglect. While Physical abuse is the predominant abuse in non-indigenous children, it is neglect that is more investigated in the case of indigenous children.

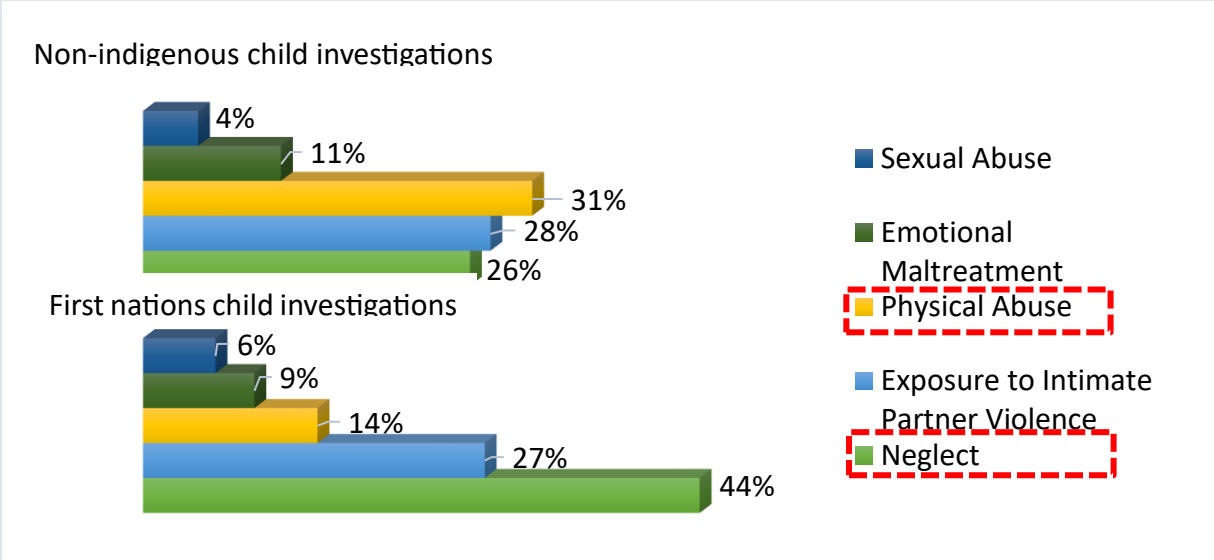


Figure 1.- Primary category of maltreatment in Canada in 2019 for First Nations and Non-Indigenous Children.

Adapted from “Denouncing the continued overrepresentation of First Nations children in Canadian child welfare: Findings from the First Nations/Canadian Incidence Study of Reported Child Abuse and Neglect-2019. Ontario: Assembly of First Nations”, by Fallon, B et al.,2021.

The analysis conducted by the authors in (Fallon et al., 2022) indicates that sexual abuse is more prevalent in children older than 12 years, while children from 8 to 11 years old have a uniform representation in all types of abuse. This explains why this group was selected as the target of the proposed serious games. Figure 2 presents the cases of maltreatment by age.

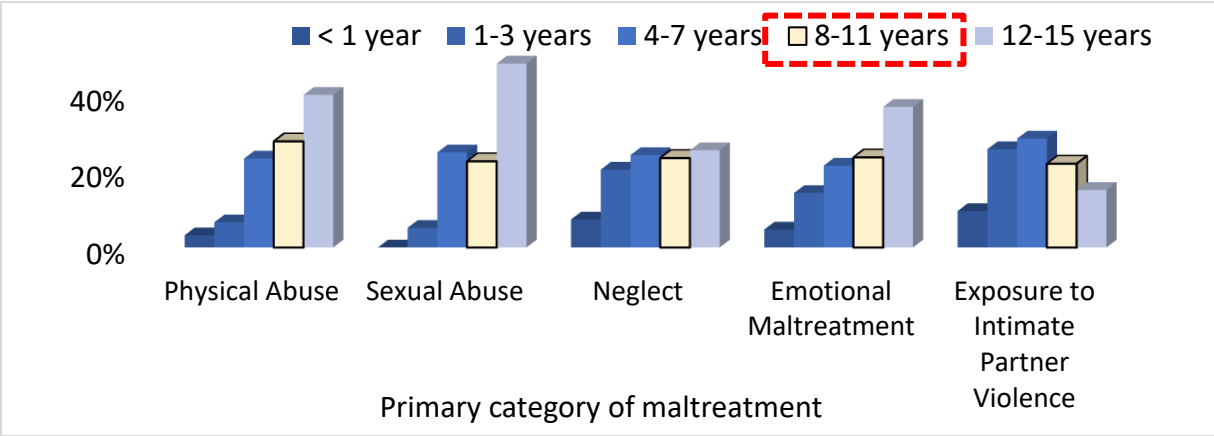


Figure 2.- Child age by primary category of substantiated maltreatment, in Canada in 2019

Adapted from “Major Findings from the Canadian Incidence Study of Reported Child Abuse and Neglect 2019”, by Fallon, B et al.,2022.

The statistics provide a general visualization of the status of this problem in Canada, based on the cases that have been reported. The issue of violence against children is widespread, yet it is often concealed, overlooked, or left unreported (UN World Health Organization (WHO), 2016). In Canada more than 70 percent of the cases remain anonymous because victims did not disclose the problem until they after they became 17 years old (Burczycka *et al.*, 2017). Moreover, they do not disclose this problem because they are not fully aware that they are being abused or they are unable to ask for help (Trocmé *et al.*, 2010).

2.3 Child Abuse Prevention Programs

Due to the impact of child maltreatment in our society, governments invest in designing programs to prevent child abuse (Child Abuse & Neglect, 2021; Government of Canada, 2001). The authors in (Fortson *et al.*, 2016) present a set of strategies, programs, and approaches to prevent child abuse. These strategies include strengthened economic supports to families, providing quality care and education early in life, enhancing parenting skills to promote healthy child development, intervening to lessen harms and prevent future risks, and changing social norms to support parents and positive parenting. Changing social norms strategies implies the creation of public educational campaigns and legislative approaches that focus on ways to change behaviors related to child abuse and highlight the impact of any form of violence. The aim is to make people aware of these situations (Child Welfare Information Gateway., 2021; Fortson *et al.*, 2016; UN World Health Organization (WHO), 2016).

Canada also considers similar strategies and collaborates with The World Health Organization, government and non-governmental organizations to create prevention programs (Government of Canada, 2001; UN World Health Organization (WHO), 2016). Among these strategies, we focus on those that provide data about child abuse and also develop educational campaigns.

Organizations, with the support of the Government of Canada (Public Health Agency of Canada, 2019), address many forms of violence. Organizations such as *Canadian Centre for Child Protection* provides educational and prevention materials to legal guardians and parents to educate children on abuse and exploitation of kids online and offline (*Programs & Initiatives*, n.d.) Among these educational materials we have the national education program “Kids in the know”

and also “Be Smart, Strong & Safe,” “Zoe & Molly Online” and “Teatree Tell ”. The first one educates teenagers on personal boundaries through activity books. The “Zoe & Molly Online” program teaches children to be safe while playing online games. This tool uses comics and games to cover the subject. The “Teatree Tell” educational material is a Child Sexual Abuse (CSA) prevention kit for educators and parents that contains storybook, journal page, and questions to discuss, and even includes puppets. Other topics related to abuse, such as videos, activity books and electronic lessons, are resources provided on its web side.

The Canadian Red Cross provides in person and online educational programs about Violence and Abuse Prevention focused on children, youth, parents and educators. Among their programs designed for educators are Child Abuse and Neglect Prevention, Healthy Youth Dating Relationships and Bullying and Harassment Prevention (*Violence and Abuse Prevention - Canadian Red Cross*, n.d.). In Child Abuse and Neglect Prevention programs, we can find “Be Safe”, a program focused on CSA, whose target is children between 5-9 years old, and contains books. We also have “It is not your fault”, designed for young kids between 12 to 18 years old, that covers, through workshops, children’s rights and the four kinds of abuse.

The Marie Vincent Foundation is another center for prevention that focuses on preventing sexual abuse. This center develops material such as books, videos, and games to teach children and teens about concepts related to sexual violence (*Prévention*, n.d.)

Among the topics covered in child maltreatment prevention programs we have: definitions, examples of maltreatment, recognition of body parts and private parts, dangerous situations, children’s rights, tips to help disclose the problems and reinforcing that it is not the children’s fault and self-defense.

The statistics reported in Section 2.2 suggest that there is existing evidence of significant cases of negligence and other forms of violence; however, most of the tools mentioned above are focused on sexual abuse and bullying.

The existing child abuse prevention programs include, in some cases, minigames as part of their tools. The use of SGs to prevent child abuse is addressed in the next section.

2.4. Serious Game to Prevent Child Abuse

In the social field, particularly in areas focused on prevention, SG becomes a convenient tool for abuse prevention because SG allows the player to learn through the simulation of real experiences and exploring environments (de Freitas, 2006; Jones *et al.*, 2020). It reproduces complex situations or unsafe scenarios that cannot be reproduced in the real world due to logistics costs and safety reasons (Corti, 2006; Oliveira *et al.*, 2012; Susi *et al.*, 2015). Behavior change, knowledge acquisition, and soft and social skills are expected outcomes that can be achieved using SGs (Boyle *et al.*, 2016).

There are SGs designed to prevent abuse, for example Mela, a self-education tool created to address sexual and gender-based violence (SGBV), aimed at college instructors, where the designers work on practices in research-creation and processes in participatory SG design. It uses real-life cases to teach instructors how to identify cases of abuse, how to deal with them, and impart concepts like the effects of abuse, encouraging female students to report incidents, and other topics like early marriage, personal hygiene, unplanned pregnancy, and transactional sex (Sadati & Mitchell, 2021).

Campus Craft is a prototype, designed to prevent sexual assault, targeted at college students. It covers concepts related to sexual consent, rape culture, and sexual health through a game that simulates real scenarios that students face. Findings revealed that the students acquired prevention concepts and scored highly on the post-test (Jozkowski & Ekbia, 2015).

In bullying or cyberbullying prevention, the authors in (Calvo-Morata *et al.*, 2020) analyzed more than 30 serious games and study their mechanisms to prevent and detect this kind of abuse and how they were evaluated. Among those we have Conectado, a SG addressed to young people to prevent bullying and cyberbullying. It is a first-person point&click 2D graphic adventure. Game Learning Analytics and Game Analytics were techniques used to evaluate if the game accomplishes the goal and engages the students (Calvo-Morata, 2021). Kiva is an antibullying program targeted at children and teenagers, which includes games, and has evidence to reduce the effect of victimization and cyberbullying. This program is based on prevention, intervention and monitoring (*KiVa Is an Anti-Bullying Programme | KiVa Antibullying Program | Just Another*

KiVa Koulu Site, n.d.; Yang & Salmivalli, 2015). Cooperative Cybereduca 2.0, a cooperative video game targeted at children between 11 to 15 years old, formed part of the psychoeducational intervention program aimed to reduce the incidence of cyberbullying, promote cooperative conflict resolution strategies, and foment correct social behaviors. The SG was experimentally validated and its results showed that it achieved the characterizing goal (Garaigordobil, 2018). Monité is a videogame targeted at children between 6 and 11 years old and is also a part of an educational program. The SG educates through an implicit learning concept on bullying and stimulates social skills such as empathy, self-esteem and conflict resolution (*Prevención Del Bullying - Monité*, n.d.).

Orbit Rescue was designed to prevent child sexual abuse. It focuses on encouraging children aged 8 to 10 years old to recognize what child abuse is, what to do, and how to disclose using an evidence-based approach (*Play Orbit Rescue « Orbit*, n.d.). The topics covered are: Need to Tell, Barriers to Tell, Healthy Self Concept, Modes of Communication, Offender Tactics, Private Body parts, Public and Private spaces, Tell and Keep on Telling, The Body rules, and Trusted adults. This game was tested in school and the results support the benefits (Jones *et al.*, 2020). The authors in (Scholes *et al.*, 2014) mention that active participation, explicit training, standardized material, integration into the school curriculum, parental involvement, and longer programs with reinforcement are vital elements to include in preventing sexual abuse effectively. They also indicate that the Orbit Rescue game has considered these features.

In Google and Apple Play Store, using keywords such as “Child maltreatment”, “Child abuse”, “Prevention”, “Protection”, and searches constrained to any abuse aimed at children under 16 years old, three serious games emerged: “Child Abuse Prevention”, “Stop the Groomer” and “Feel Safe - Personal safety”. “Child Abuse Prevention” is focused on children between 6 to 8 years old. It develops topics related to sexual abuse, such as private body parts, unsafe touch, say no, offenders, and circle of trust. It was tested by non-government organizations and some kindergartens and schools (*Child Abuse Prevention*, 2019). The “Stop the Groomer” game is for 9–11-year-old children and it covers tactics used by abusers to help children recognize them and to keep safe. The game contains 27 quiz-like scenarios to reinforce the lessons. These lessons include: What sexual abuse is, how to stop a groomer, if it happens to you, and tips to keep you

safe (*Stop the Groomer*, 2018). “Feel Safe - Personal safety”, designed for 12-16 years old, teaches about CSA and how to face it. In this case the author mentions that the game is designed for teenagers with mild intellectual disability or Autism Spectrum Disorder (Feel Safe - Personal Safety, nd).

In summary, most serious games to prevent child abuse focus on sexual abuse and bullying. A review of the use of digital games in managing child abuse shows that serious games only address sexual abuse in the prevention field (Asadzadeh *et al.*, 2022).

The Serious Game proposed in this work addresses the four kind of abuse which, to the best of our knowledge, has not been addressed before in the literature. However, to better distinguish our Serious Game, a comparison with the existing SGs aimed at child abuse is provided in the next Section.

2.5 Comparison of Serious Games in Child Abuse.

This section provides a comparison among the existing Serious Games for child abuse. This comparison exhibits detailed gaps this work seeks to fill. But, first, the criteria for the comparison are introduced.

Serious games are widely accepted nowadays because of their achieving the learning objectives while keeping the audience entertained (Arnab *et al.*, 2015; Stone, 2008). The authors in (Caserman *et al.*, 2020) emphasize that the game must support the player to achieve the characterizing goal and maintain the player experience. However, to fulfill its essence, there are criteria and considerations to follow. These criteria help SG achieve effectiveness and attractiveness (Caserman *et al.*, 2020; Nilsson *et al.*, 2020; Sweetser & Wyeth, 2005).

There are quality criteria for an appropriate game design, which focus on the Game Experiences (GX). The authors in (Carvalho, 2017; Dörner *et al.*, 2016) mention that the game has to captivate the players, and some factors such as gameplay mechanisms, interactivity, game interface, narrative, multimedia player, and clear rules must be included. Also, appropriate assessment means that the SG has to let players track their progress, provide a quantitative measure of

development, give adequate feedback, and motivate through game mechanisms, rewards and challenges.

The authors in (Sweetser & Wyeth, 2005) propose a structured model to help players enjoy games with eight elements: *concentration*, *challenge*, *player skills*, *control*, *clear goals*, *feedback*, *immersion*, and *social interaction*. *Concentration* means the game must provide value and many stimuli from different sources, and must consider the target. *Challenges* suggests gradually increase difficulty levels. *Player skills* suggests that the skill development of the audience must be considered. *Control* emphasizes that the player should feel and know the effect of their decisions. *Clear Goals* demand that the game provides appropriate goals and time; while in *Feedback* and *immersion*, the player should feel motivated and involved in the game. Finally, *social interaction* encompasses competition or measurements of their progress.

Achieving the characterizing goals can be done effectively if the serious game follows recommendations such as: establishing objectives or skills to develop, providing support to the players to achieve them, identifying the abilities and preferences of the target audience, selecting effective learning methods and strategies, and evaluating whether the content is accurate, pertinent and appropriate for the target audience. These suggestions have been proposed by in Carvalho (2017), Dörner *et al.* (2016), and Popescu *et al.* (2011).

The authors in (Caserman *et al.*, 2020) gather a quality criterion to find the balance between the game aspect and the characterizing goals. They divide the SGs into two parts, the serious parts that concerns characterizing goals, methods, and quality; and the Game part, which includes the enjoyment and media presentation. Their work provides high-quality criteria for both parts and especially remarks on the criteria for balancing the serious and game parts. Some criteria will be taken into account in the design and evaluation section. In Table 2 the criteria and aspects are grouped by serious and game part of SG and balance.

The authors in (Nilsson *et al.*, 2020) provide some aspects to be considered when the SG is targeting children, and most of them overlap with the criteria mentioned above. They are focused on design, dynamics, and experiences but remark on how these criteria can be addressed, considering cognitive and physical abilities. For example, the providing feedback criteria must be

given immediately to avoid impatience, using few words and appropriate language for the player’s level, recommend using speech feedback and graphics elements instead of written text. Most of the suggestions from these authors were considered and they are detailed in the design of the serious game.

Table 2.- Criteria and aspects for Serious games

Parts of Serious Game	Criteria and aspects
Serious Part	<ul style="list-style-type: none"> Focus on the characterizing goal - Clear goals. Indispensability of the characterizing goal. Correctness of the domain expert content. Appropriate feedback on progress and rewards. Proof of effectiveness & sustainable effects. Awards and ratings.
Game part	<ul style="list-style-type: none"> Ensure player engagement and experience. Ensure flow. Establish an emotional connection. Sense of control. Support social interactions. Ensure immersive experience. Media presentation, attractive graphics and appropriate sound.
Balance between the serious part and the game part	<ul style="list-style-type: none"> Embedding characterizing goals into the gameplay. Scientific foundation. Appropriate interaction technology. Intuitive game mechanics and natural mapping. No simplifying of the learning and/or training process due to technical features. Avoid adverse effects.

Adapted from “Quality Criteria for Serious Games: Serious Part, Game Part, and Balance”, by Caserman *et al.*, 2020.

A list of serious games to prevent child abuse was detailed in section 2.4. Therefore, an evaluation was carried out to identify opportunities and best practices from these games, considering some criteria. To start this evaluation process, all the serious games that were not addressed to children

were discarded. To this, the criteria given by (Caserman *et al.*, 2020; Nilsson *et al.*, 2020) were adapted to children. Table 3, shows the selected criteria adapted to children to evaluate some SGs.

Table 3.- Criteria to evaluate SGs for child abuse prevention

	Criteria	Explanation
1	Clear learning objectives	Goals are clear so players can work towards the characterizing goal.
2	Cognitive developmental	Consider their cognitive skills to apply learning strategies.
3	Feedback	Players should receive feedback on their performance and progress. Visible and recognizable effects. Provide simultaneous feedback using visual and audio formats or text, using short text.
4	Ensure player engagement	Serious games should be engaging and enjoyable. It must have clear and concise rules.
5	Rewards	Provide positive reinforcement frequently. Graphic elements are used.
6	Media presentation	Graphics must be appropriate for the game’s purpose and children. Include appropriate background music and sound effects.
7	Immerse experience	Include multimodal sensory stimulations: visual, audio, haptic.
8	Ensure flow	Provide varied gameplay according to the physical development of children.

Adapted from “Quality Criteria for Serious Games: Serious Part, Game Part, and Balance”, by Caserman *et al.*, 2020.

An ordinal scale was used to measure the criteria, which provides meaningful insights into the degree of compliance with the requirement described. The structure of the Likert scale is: Full compliance with a score of 4 points, substantial compliance with 3 points, mediocre compliance with 2 points, and low/non optimal compliance with 1 point. Table 4 shows the scores obtained by the serious games designed to prevent child maltreatment.

Regarding the *clear learning objectives criteria*, the serious games evaluated establish the objectives or skills to be developed within the game and all the activities contemplate and support the characterizing goals, hence obtaining the maximum score. On the other hand, most of the

games do not provide activities that stimulate the student’s cognitive level. Many of them only demand the player to select an option and leave out activities that promote communication skills or problem-solving according to their level. Only in Orbit Rescue game, children 8-10 years old must read an email and respond appropriately which evokes reading comprehension and writing. Regarding *feedback*, most of the SGs immediately respond to the action, but some of them do not use visible or audio elements. On the contrary, almost all of them work on making a friendly and fun game using other features, like storytelling, background, or a simple mechanism. Thus, they get a high score in the *immerse experience* and *media presentation* criteria.

Badges are a common element used as *Rewards*. The points system is not frequently used and, in some cases, the reward is to complete the game.

Table 4.- The evaluation results for a SG aimed at reducing child abuse

Title \ Criteria	Child Abuse Prevention	Stop the Groomer	Orbit rescue	Feel Safe - Personal Safety	Conectado
Clear learning objectives	4	4	4	4	4
Cognitive developmental	2	2	4	2	2
Feedback	4	3	3	2	2
Ensure player engagement	4	3	4	3	3
Rewards	4	2	4	2	1
Media presentation	4	2	4	3	3
Immerse experience	4	3	4	2	3
Ensure flow	2	2	4	2	2

Full compliance (4 points)

-

Low/Non optimal compliance (1 point)

With respect to *The Ensure Flow* criterion, the SGs have obtained a low rating because the activity focused on reinforcing the knowledge only offers a multiple choice option. The exception was

Orbit, whose gameplay involves mini-games such as grab-and-drag, overcoming obstacles, and identifying correct images.

Important insights were discovered during the analysis of SGs designed to prevent abuse or child abuse. The key for prevention is educating people about abuse and its various forms (Canadian Resource Centre for Victims of Crime, 2022). However, many prevention tools focus solely on sexual and bullying abuse, despite child abuse being categorized into four types. Neglect, which was found to have a significant presence in Section 2.2, was lacking material aimed at children in the prevention tools, the majority intended for teachers and parents. Children need to be informed about neglect and empowered to speak up when they are victims. Therefore, other types of child abuse must be addressed, along with related subcategories and topics. For instance, emotional abuse goes beyond bullying and cyberbullying and can also include scenarios such as witnessing family violence or threatening children to be removed from their home. A serious game is necessary to fill this gap.

Another area that needs to be addressed is considering children's cognitive and physical development when designing learning strategies and game mechanisms that reinforce characterizing goals. Also, as SG is a platform that allows blended learning solutions for different learning groups (de Freitas, 2006) and allows for the development of a mechanism that covers the different levels of thinking skills (Lim *et al.*, 2013), there is an opportunity to explore and promote skills like argumentation, reading comprehension, and writing that evoke children's competences. Hence, this work proposes the design of a Serious Game focused on the four types of abuse, and aimed at children aged 9-11 years old. This Serious Game includes all the criteria mentioned above and deepens into *feedback*, *ensure flow* and *cognitive developmental*. The next chapter introduces the methodology used in Serious Games designing.

Chapter 3. The Design of the Serious Game

This chapter delves into the Serious Game ZeroAbuse, providing details on its design. Firstly, it outlines the objectives and competencies of the Serious Game. Later, the design of the course is described, as there was no available curriculum of prevention based on cases of the chosen topic of child abuse. Lastly, the structure of the serious game is defined, taking into account the criteria and frameworks created to link and support the pedagogy and game parts.

3.1 ZeroAbuse - Serious Game

3.1.1 General and Specific Learning Objectives

The main purpose of designing and implementing this SG is to teach children to recognize abuse situations through a game experience and innovative learning methods. The general and specific learning objectives considered to develop the game are described in Table 5.

Table 5.- General and specific learning objectives of ZeroAbuse

General objective	Specific objective
1. To recognize several ways these types of abuse manifest.	Identify situations of abuse. Recognize who can be the aggressor. Perceive the consequences of living abuse.
2. To know what sexual, physical, emotional abuse and neglect are.	Provide concepts of abuse and classification.
3. To respond appropriately to an unsafe situation.	Empower to disclose the problem. Be aware facing unsafe situations. Know the children's rights. Be familiar with the mechanism of help.
4. To increase the sense of empathy.	Analyze unsafe situations that other children may be experiencing. Recognize how the victim feels. Identify how they can help.

In addition to the learning objectives mentioned earlier, enhancing social skills and cognitive competencies are also pursued in this work. Social competencies include cooperation, mutual support, and moral judgments, while cognitive competencies involve understanding, attention, and active communication. These competencies serve as guidelines to achieve success in the game.

3.1.2 Model Definition

To carry out the realization of this promising mechanism that allows us to fulfill the proposed objectives (Characterizing Goals), Participatory Design (PD) is combined with the typical model that includes user testing and provides feedback to improve the game. Participatory Design is ideal when the designer and player have very different profiles because it incorporates diverse knowledge from different domain experts and allows them to participate in the design process (Dörner *et al.*, 2016; Khaled *et al.*, 2014; Spinuzzi, 2005). Related to PD, this work considers a framework developed to build serious games as a guideline. This framework is based on: player-centered design, iterative development, interdisciplinary teamwork, and integration of play and learning (Abeele *et al.*, 2012). Figure 3 presents the model implemented to develop the serious game.

The design process starts by defining an interdisciplinary teamwork (Dörner *et al.*, 2016). This team is formed by teachers, psychologists, children and parents, who provide their expertise, perspective and knowledge. The psychologist gives guidelines about preventing child abuse and understanding the problem domain. Teachers provide guidelines about how to teach, focusing on methods and strategies of learning according to the children's competences. The parents know the children's interests and how to deal with them from different perspectives, and finally, children confirm some facts about their interests and preferences.

Integrating all this information implies an interactive development. This cycle comprises the stakeholder, knowledge, and feedback. The data is gathered, processed and shared with other corresponding members to analyze and validate it. When the information is accepted, it is transformed as input for the game. The roles of the team are extended to approve the integration of the transformed knowledge into the game. In the case of children, they validate their point of

view of some minigames, mechanisms and scenes in the game. The tools for this purpose are focus groups, observation and open questions. The cycle ends when the consensual topics are covered, the presentation formats are agreed, and the game's mechanisms are approved. The process gives meaningful participation to all users involved.

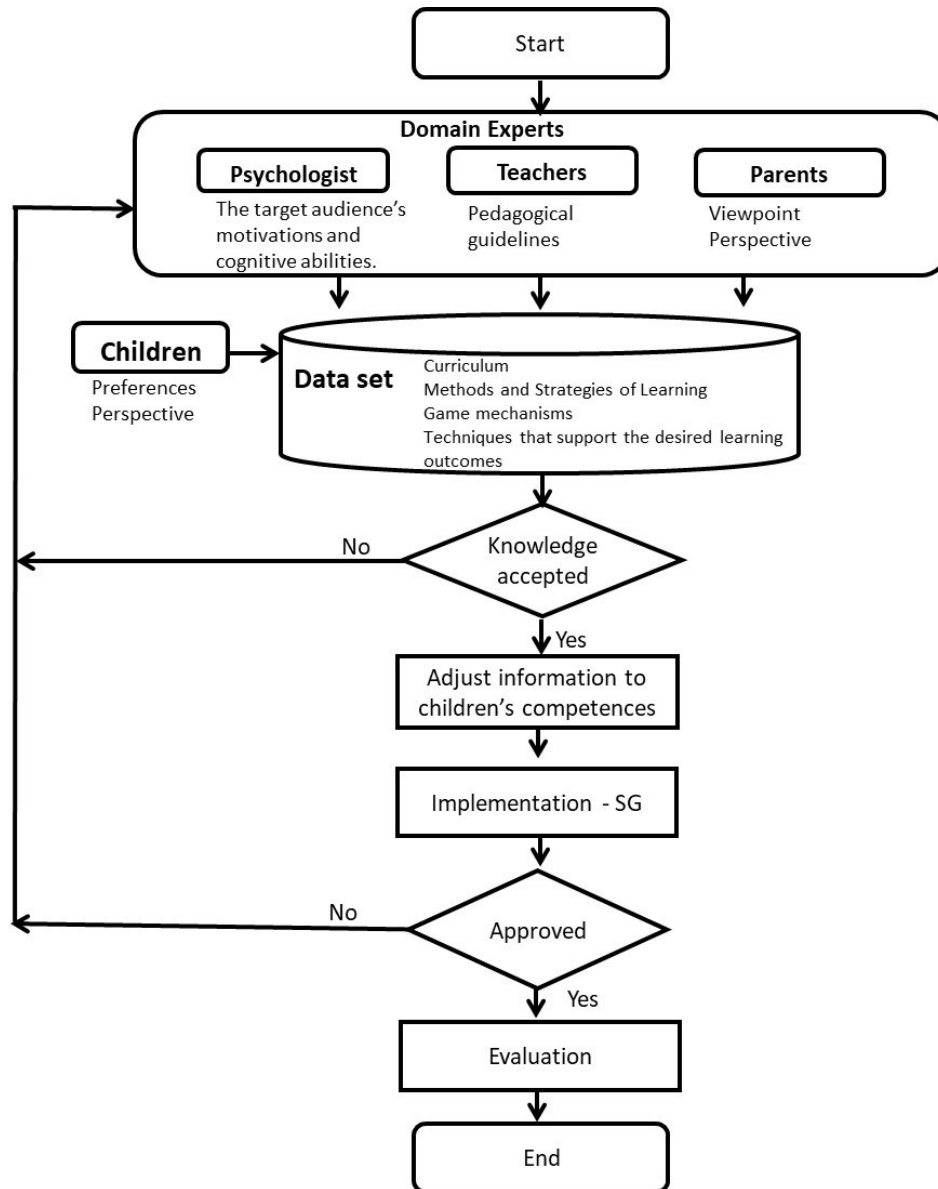


Figure 3.- Development process of ZeroAbuse

The game is constantly evaluated during the design process. However, a second phase is included. This phase involves the evaluation of the SG with external users (persons not involved in the design process) to refine the prototype. Some suggestions mentioned in (Caserman *et al.*, 2020)

are used as a framework in this stage. Students of Artificial Intelligence (AI) and experts in the field of prevention of abuse were consulted for this second phase. Finally, the target audience evaluate the game in order to know the impact of the game and validate if it achieves the objectives.

As the existing materials do not focus on all classifications or are mostly aimed at other age groups, it is necessary to develop content for this purpose. For example, cases of negligence and exposure to family violence are focused on parents or caregivers and it is difficult to find material addressed to children. The next section presents a methodology for developing prevention content thereof.

3.2 Course Design

3.2.1 Analysis of the Target Audience

Identifying the developmental competencies of middle childhood (9-11 years) is necessary to effectively convey knowledge when building the prevention course for the SG and its components. In middle childhood, children can solve concrete problems using logical problem-solving strategies. They start solving hypothetical problems using abstract concepts, making their reasoning more logical. Also, their reasoning becomes more complex, they can generate new ideas and their sense of empathy increases. During childhood, they deem the opinion of their friends as important. They also need to belong to a group as they experiment with emotional changes. Moreover, children in middle childhood learn by themselves, improve their organization and increase their reading comprehension (CDC, 2021; Charlesworth *et al.*, 2011; Coll & Szalacha, 2004).

The content for the target audience, considering the corresponding competences mentioned here, is described in the next section.

3.2.2 Content Design

The related concepts were extracted from the Department of Justice Canada and The Canadian Child Welfare Research website. Addressing neglect, emotional, sexual and physical abuse implies

a significant number of topics to cover, that increases even more if it includes different ways each kind of abuse is manifested.

To determine the topics to address, it is important to recognize that various types of abuse can appear in several forms. Sexual abuse, for instance, includes touching and non-touching behaviors such as taking photographs of a child in sexual poses, sex talk, or sexual exploitation. Table 6 outlines abusive behaviors related to child abuse by type. There is also a vast number of recommended topics to address to prevent each type of abuse. For example, to prevent sexual abuse, experts as in (Daniels, 2023; Finkelhor, 2023; Tutty, 1995) suggest covering a range of topics such as body ownership, identifying good and bad touches, and protecting private parts. However, addressing some abusive behaviors and recommended topics may require substantial time. For example, Orbit, an SG, may take around 5 to 10 weeks to cover topics such as identifying how to report the problem, trusted adults, offender tactics, and private parts through a case of abuse (e.g., adult touches a child’s private parts).

Table 6.- Examples of abusive behaviors.

Category	Examples of abusive behaviors
1. Physical abuse	Harsh physical discipline, forceful shaking, pushing, grabbing, throwing, hitting, punching, kicking, biting, choking, strangling, stabbing, burning, shooting, poisoning, and the excessive use of restraints.
2. Sexual abuse	Penetration, attempted penetration, oral sex, fondling, sex talk, voyeurism and sexual exploitation.
3. Neglect	Failure to supervise, leading to physical harm or sexual harm, permitting criminal behavior, physical or medical neglect, failure to provide psychological treatment, abandonment, and educational neglect.
4. Emotional harm	Hostile or unreasonable and abusive treatment, frequent or extreme verbal abuse, causing non-organic failure to thrive, emotional neglect, and direct exposure to violence between adults other than primary caregivers.
5. Exposure to family violence	Allowing a child to see, hear or otherwise be exposed to signs of the violence.

Reprinted from “Child Maltreatment in Canada: Overview Paper”, by Public Health Agency of Canada.

On the other hand, some facts must be considered to develop the game that helps change some paradigms. For example, girls are the victim profile associated with child sexual abuse even though boys are also victims. Data from 2010 show that males represent 12% of sexual assault victims (McDonald & Tijerino, 2013). Another paradigm is that the abuser is someone unknown, while in all types of abuse, including sexual abuse, the abuser can be a known person. The facts shows that most perpetrators are not strangers; they are known people, and in many cases, relatives of the victims (Department of Justice Canada, 2013). The facts presented in Table 7 were used as scaffolding for building materials to incorporate into the game.

Table 7.- Relevant facts in child maltreatment

Category	Important issues
Physical abuse	The perpetrators of violence are mainly parents, then other relatives such as cousins, grandparents or siblings (Allen, 2016). Men are more likely to suffer physical abuse than women (Allen, 2016).
Sexual abuse	Even though women are three times more likely to be victims of sexual abuse than men, the number of cases in men is still significant (Allen, 2016; McDonald & Tijerino, 2013). Men victims have been abused by non-relatives more than by relatives (Allen, 2016). In most cases, the perpetrators are known by the child (Canadian Resource Centre for Victims of Crime, 2022).
Neglect	Regarding the neglect subtypes, significant participation corresponds to a supervision failure: physical harm and physical neglect followed by abandonment and educational neglect (Blumenthal, 2015).
Emotional abuse	The forms of substantiated emotional maltreatment with significant participation are verbal abuse or belittling, exposure to non-partner physical violence and inadequate nurturing or affection (Kozlowski <i>et al.</i> , 2014). Children who witness violence by parents have reported being victims of childhood physical or sexual abuse (Kozlowski <i>et al.</i> , 2014).

Given the extensive range of material, it is necessary to create a methodology that allows an effective communication channel. Also guidelines are needed to develop a curriculum that shows

different forms of abuse, taking into account the most relevant issues about abuse jointly with the competencies and preferences of children from 9-11 years old. The aim is to help them recognize if they are being abused and how to deal with it. The methodology used to design the content of the SG is described below.

Methodology to design a prevention course for children.

- 1. Team Integration:** Integrate a team that provides the guidelines and validates the information.
- 2. Data Collection:** Analyze information, policy, norms, and statistics regarding child abuse.
- 3. Objective Definition:** Define the learning objectives and extract the related topics and subtopics.

4. Repeat for each type of abuse:

4.1 Database Definitions: Create a database of child abuse definitions.

4.1.1. Collect concepts from entities endorsed by the government and centers of prevention.

4.1.2. Gather the support mechanisms, according to region, in cases of child abuse.

4.2. Language Adaptation: Adapt concepts to middle childhood language.

4.3. Abusive Behaviors Database: Create a database of abusive behavior.

4.3.1. News and Media Data Collection: Gather news and facts about this type of abuse, analyze films and series, and collect images of cases of abuse.

4.3.2. Choice of situations: Select situations of abuse and other material that appropriately reflect the kind of abuse.

4.3.3. Characteristics Extraction: Extract the story, profile, and behavior of the victim and the abuser, the tactics used, the dialogue involved, and other characteristics of the situation, such as the personality of the victim and signs of maltreatment.

4.3.4. Sketch Designing: Sketch the abuse situations according to middle childhood language.

4.4. Sketch and Concepts Validation: Validate the concept and the sketch of the abuse situation.

4.5. Selection of Topics and Cases: Determine the topics and cases of abusive behaviors according to Algorithm 1

4.6. Materials development: Elaborate the materials based on the learning method selected. Design videos and infographics that contain the concepts. Design the scenarios and the dialogues and the reinforcement, feedback, and hints activities.

A detailed explanation of each step in the methodology is provided below.

Team Integration (1): The experience of the experts and its pertinence to the topic are key when defining the team. In the case of preventing child abuse, a psychologist and teacher form the team and their main contributions in the domain are shown in Figure 4.



Figure 4.- Guidelines of domain experts

Data Collection (2): It allows the team to get into the context of the problem and review various aspects of the issue and how they are being addressed.

Objective Definition (3): Based on the information gathered in Data Collection, the objective and subtopics are determined. Figure 5 illustrates the educational approaches to reduce child maltreatment. They allow us to find ways to cover the four types of abuse and the subtopics to focus on.

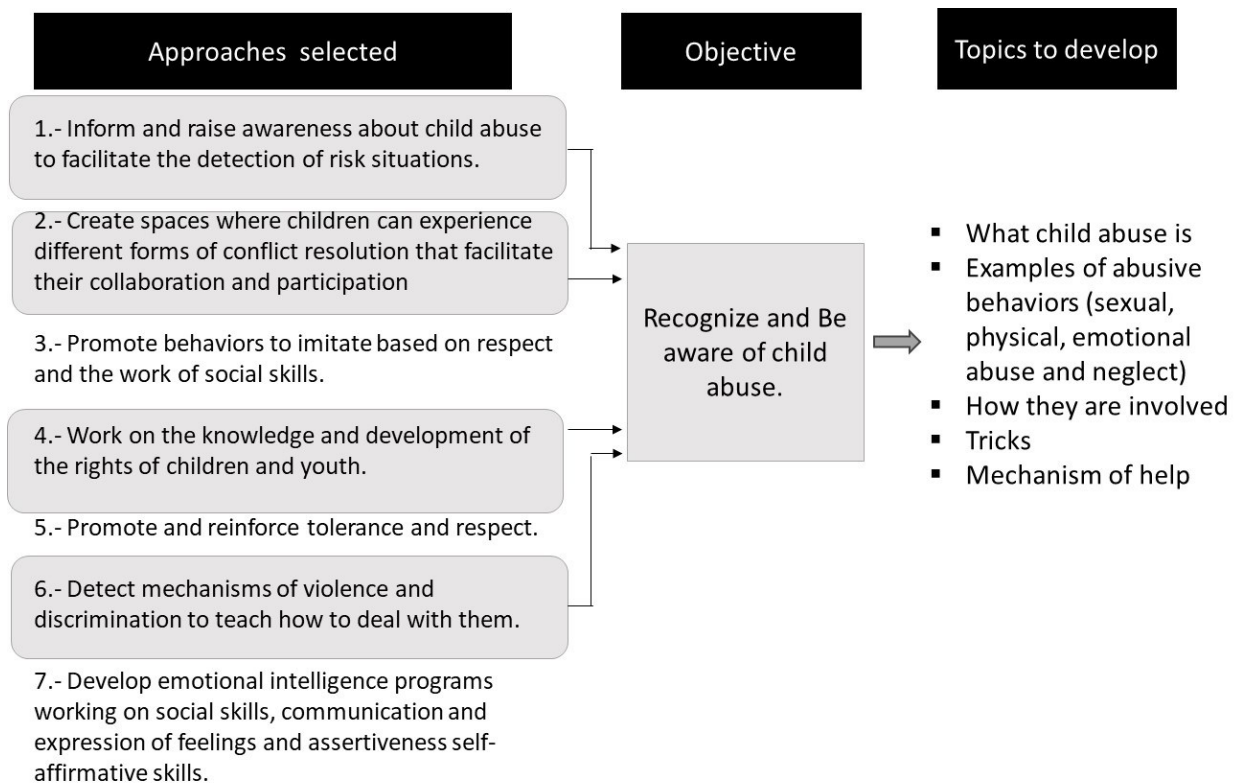



Figure 5.- Example of extraction of subtopics

Database Definitions (4.1.1) and Language Adaptation (4.2): Create a database of definitions from entities endorsed by the government and centers of prevention and paraphrase to the language understood by children.

It is important to collect definitions from official sources which, in this case, correspond to Governments and Prevention Centers. These definitions work as a baseline as they already consider cultural aspects of the region. However, such definitions are not always easily understood by children. Therefore, the corresponding team experts customize the definition to be useful for them. For the sake of explanation, an example of neglect abuse is presented. Although neglect is a type of abuse with substantial participation in Canada (see Chapter 2), the terminology that this classification encompasses is not well-known. The resources on the subject are addressed to adults (parents) and the existing theories of neglect overlap with other theories of child maltreatment (Blumenthal, 2015).

Also, it is essential to remark that the government must endorse the resources to avoid misunderstandings. For example, not having a child attend school is an example of child neglect outside of Canada (American Psychological Association, 2008) meanwhile, in Canada, it is not mandatory to attend school as long as the child receives a proper educational development. Figure 6 shows an example of paraphrasing the definition of neglect addressed to the adult audience, extracted from different sources, in children’s language.

Concepts addressed to adults



Government of Canada
Gouvernement du Canada

Child Neglect I: Scope, Consequences, and Risk and Protective Factors

Definition of Neglect


The word “neglect” is associated with different connotations, denotations, causes, and consequences across disciplines as well as jurisdictions (Hearn, 2011). Neglect can be defined as caregivers’ *actions or omissions*, or it can be defined by *the effects* of the actions/omissions of the caregiver on the child (Cicchetti & Toth, 2005). Developmental psychologists define neglect as, “the absence of sufficient attention, responsiveness and protection that are appropriate to the age and needs of the child” (National Scientific Council on the Developing Child, 2012, p. 2). Social work tends to define neglect as including both “failure to provide minimum care” and “lack of supervision” that presents a risk of serious harm to a child which meets the legal standard for government intervention through child protective services (CPS) (Cicchetti & Toth, 2005, p. 410; Gilbert et al., 2009; National Scientific Council on the Developing Child, 2012). Legal thresholds for neglect also typically involve measures of severity, chronicity, and vulnerability, although the concept of “failure to provide minimum care” is rarely clearly delineated through objective standards.

The literature and legislation on child neglect may include specific reference to the four main “subtypes of neglect”: (1) physical neglect (e.g. failure to provide basic needs, or supervision in order to ensure safety), (2) emotional neglect’ (e.g. failure to attend to a child’s psychological, emotional, or social needs), (3) medical neglect (e.g. failure to provide/seek necessary medical treatment), and (4) educational neglect (e.g. failure to ensure that a child’s formal educational needs are being met; Daniel, Taylor, & Scott, 2011; English, Thompson, Graham, & Briggs, 2005; National Scientific Council on the Developing Child, 2012). Neglect subtypes, like many maltreatment subtypes, have been found to be co-occurring as well as distinct (Jonson-Reid, Drake, Chung, & Way, 2003; Kaufman, Jones, Stieglitz, Vitulano, & Mannarino, 1994; National Scientific Council on the Developing Child, 2012; Pears, Kim, & Fisher, 2008). However, much of the research on the causes and consequences of neglect does not clearly distinguish between subtypes’

Category	Definition
3. Neglect	Failure by a parent or caregiver to provide the physical or psychological necessities of life to a child

Canadian Child Welfare Research Portal

Each province and territory has **unique legislation** defining and describing responses o neglect. Assessing neglect requires a consideration of poverty and other family and community factors. Neglect includes the failure of a parent or guardian to provide a child’s basic needs such as for food, education, healthcare or supervision.



Rephrasing: Concept adapted to children

When parents or caregivers do not give a child the basic things that he needs to be safe and healthy, like food, shelter, clothing, and medical care

Figure 6.- Definition of abuse extracted and rephrased in children’s language.

Database Definitions - Gather the support mechanisms (4.1.2) and Language Adaptation (4.2): A mechanism of support encompasses resources, people, and institutions to protect children. Three main support mechanisms have been considered: call centers for support and assistance, trusted person, and children's rights. In addition, visual and graphic elements were utilized to present that information due to the preference of the audience group (Wolfe, 2001;

Almeida & Almeida, 2016). Examples of call centers for support or assistance are 9-1-1 or the local police emergency number in case of danger, *Kids Help Phone* at: 1-800-668-6868, or texting *CONNECT* to 686868 (Department of Justice, 2020).

A trusted person, in this case, identifies someone with whom children feel safe to disclose a problem or an embarrassing or dangerous situation. School teachers, police officers, parents, grandparents, and other relatives are considered as trusted persons in the proposed SG. Encouraging phrases are shown afterward to reinforce that disclosing the problem is a good decision. Examples of such phrases are: *“I am glad you told me”*, *“it is not your fault”*, *“you did your best to find help”*, *“you are brave to tell”* and *“You need to continue asking until you find someone that can help you”* (Canadian Resource Centre for Victims of Crime, 2022). Figure 7 presents examples of support system.

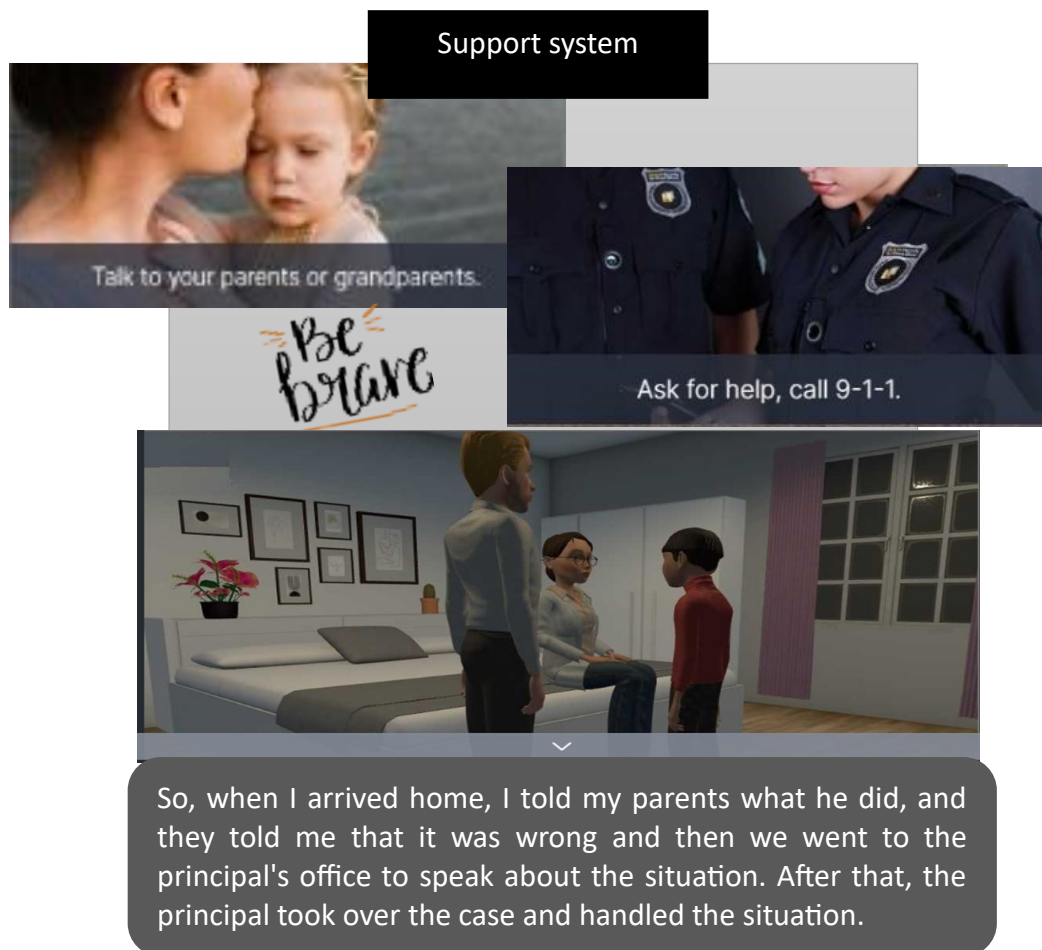


Figure 7.- Support systems

The United Nations Convention on the Rights of the Child is a human rights protocol that comprises 54 articles based on four principles: Non-discrimination, the best interest of the child, the right to life and participation. These rights exist to support and protect children and they must be respected. (Department of Justice, 2020; UN General Assembly, 1989). For example, Figure 8 presents the rights to protect children against neglect. It is adapted to children’s language.

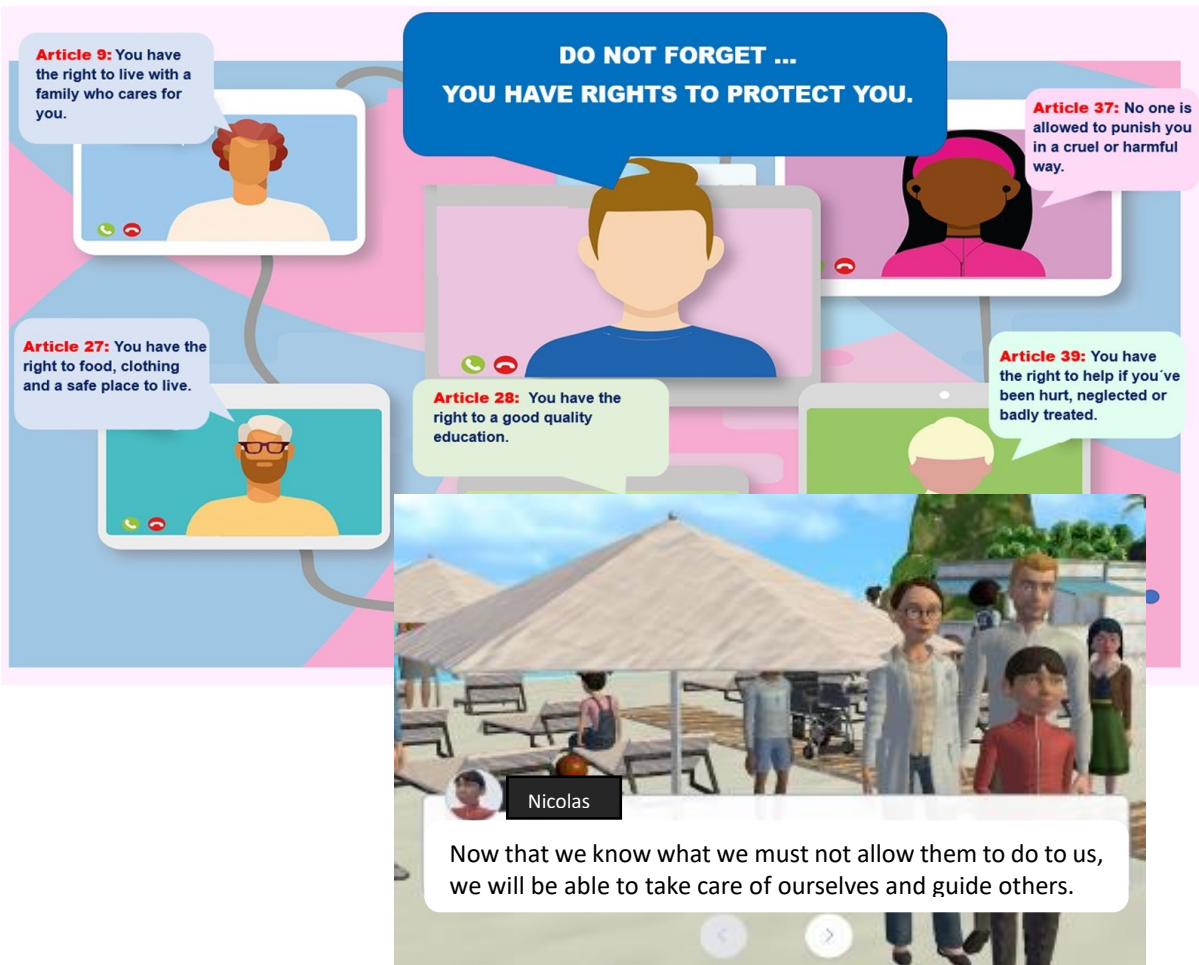


Figure 8.- Laws related to neglect rephrased to children’s language

Abusive Behaviors Definitions (4.3), News and Media Data Collection (4.3.1), Choice of situations (4.3.2), Characteristics Extraction (4.3.3): These steps imply gathering information, facts, analyzing films and series to extract the story, profile, and behavior of the victim and the abuser; the tactics used, the dialogue involved, and other characteristics of the situation, such as the personality and signs of the victim.

Figure 9 shows real-life cases and movies related to sexual or physical abuse that help build sketches, scenarios, emotions, and characteristics of the people involved. It also helps cover concepts such as private parts, good vs bad touch, no secrets, abuser's tricks and victim's feelings. Teaching concepts through storytelling and comics allows a better understanding and retention of concepts (Wolfe, 2001).

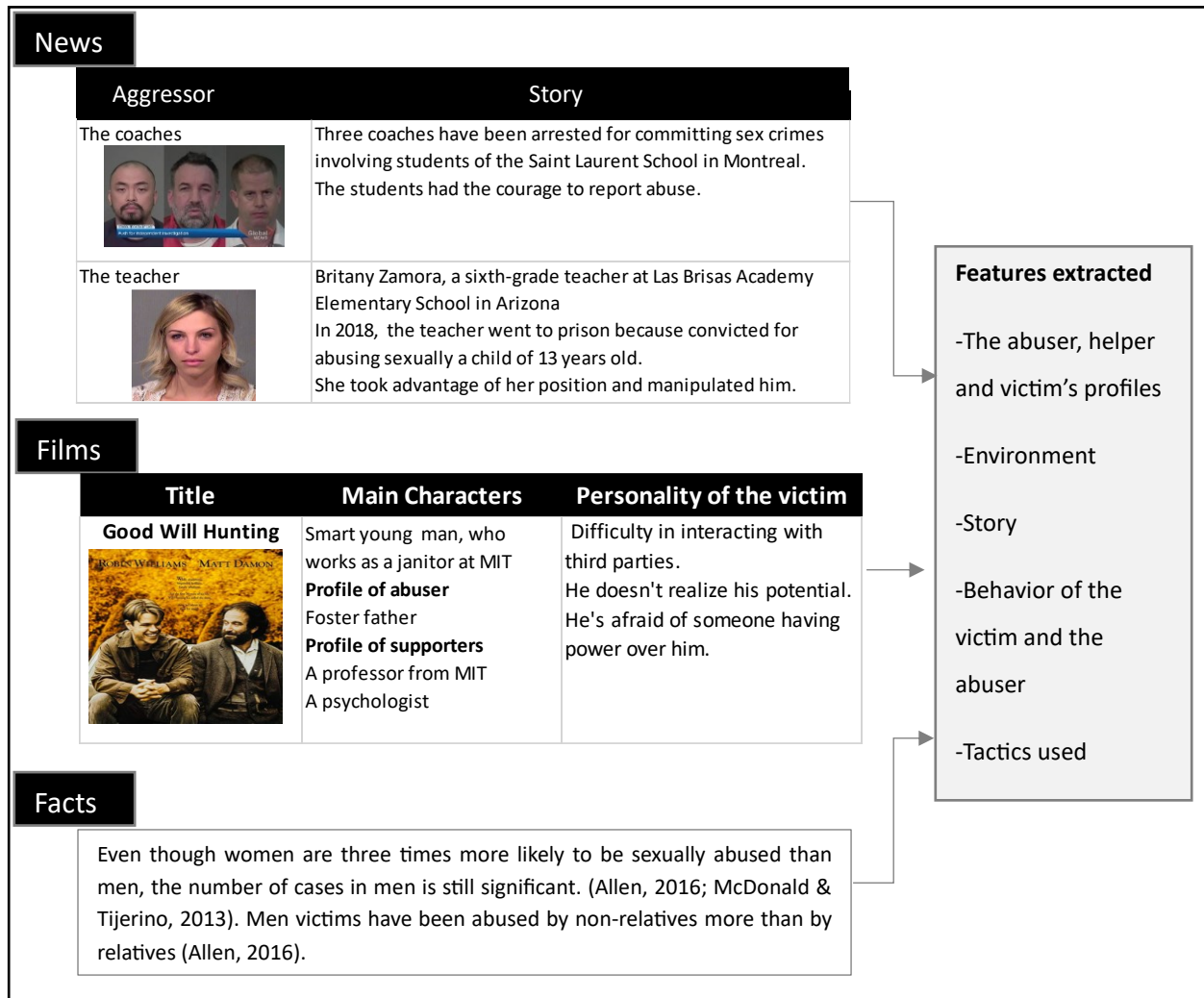


Figure 9.- Extraction of the characteristics, behavior, and emotions of the individuals involved and the scenarios.

Sketch Designing (4.3.4): This step corresponds to developing the sketch resulting from the resources analyzed in the previous step. Continuing with the same example of sexual abuse, Figure 10 presents the resulting sketch.

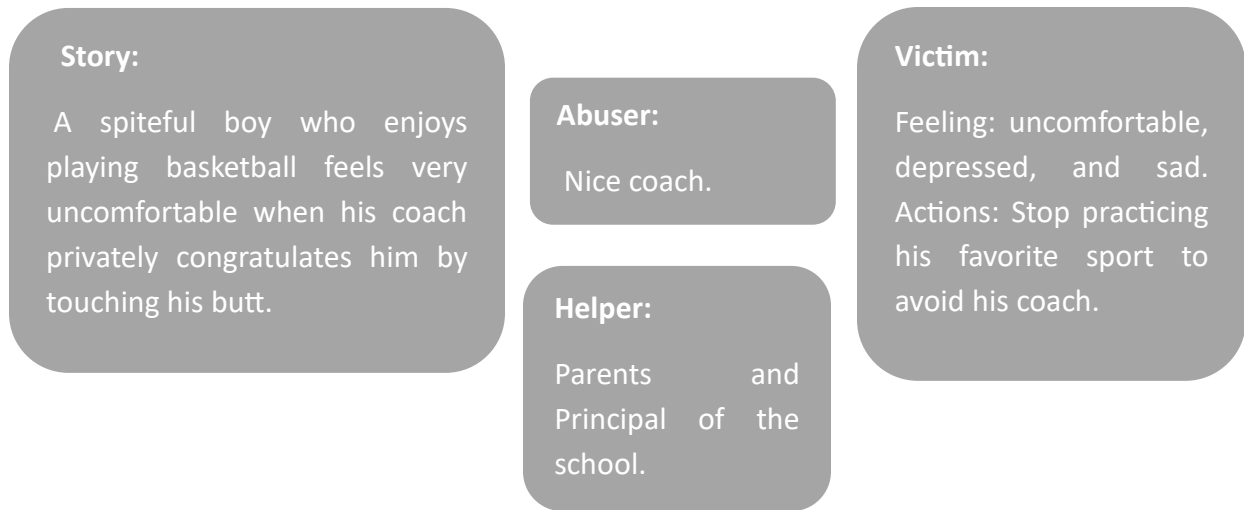


Figure 10.- A sexual abuse sketch

Sketch and Concepts Validation (4.4): Once the set of materials and sketches to be developed have been obtained, they are reviewed for appropriate modifications before graphic support.

Selection of Topics and Cases (4.5): An algorithm, denoted by Algorithm 1, is used to determine the order the kind of abuses are presented in the game, and the number of cases explored for each one of them.

First, a questionnaire is applied to identify the knowledge level for each type of abuse. Open-ended questions and multiple-choice format are used. The survey contains a set of five questions by type of abuse, allowing to get average scores, denoted by SCO_i , for each kind of abuse (See Appendix A). The scores for sexual (S), emotional (E), physical(P) and neglect(N) abuse are correspondingly denoted by $SCO_S, SCO_E, SCO_P, SCO_N$. For each kind of abuse a set of potential cases or examples of abuse is also defined. Let C_S, C_E, C_P and C_N denotes the set of cases for sexual, emotional, physical and neglect abuse, respectively. The number of cases, n , in each set is the same. Therefore, using the scores, the order and the number of cases to present in the Serious Game are determined. The scores are ordered in increasing order, hence the lower the score, the earlier the corresponding kind of abuse is presented in the Serious Game, which provides a priority for each kind of abuse. The number of cases of abuse to present in the SG is computed using Algorithm 1. This algorithm receives the scores and the set of potential cases for each type of abuse in the set {S,E,P,N}. The algorithm utilizes the scores and the cardinality of

each set C_i , denoted by $|C_i|$, to compute the number of cases to present, identified by $NCases_i$. Finally, the algorithm chooses randomly $NCases_i$ from the corresponding set of cases C_i and stores the resulting subset of cases in $Cases_i$, respectively. A formal description of the algorithm is shown in Algorithm 1.

Algorithm 1: ADC_Approach to determine the content

Input: Set of cases C_i for each type of abuse $i \in \{S, E, P, N\}$

Scores SCO_i

For each type of abuse $i \in \{S, E, P, N\}$

$$Ncases_i \leftarrow \left\lfloor |C_i| \frac{SCO_i}{\sum_i SCO_i} \right\rfloor$$

$Cases_i \leftarrow RandomSelectCases(Ncases_i, C_i)$

Output: Cases

The output of the algorithm defines the cases to present for each kind of abuse.

Materials development (4.6): This step implies: Elaborate the materials based on the learning method selected, design the scenarios and dialogues of the sketches, and create the activities of reinforcement (feedback and hints).

Elaborate the materials based on the learning method selected, ensures the reception of information covering the different types of learning by using learning methodologies and strategies. For example, video-based learning is used to teach children's rights and trusted people, and problem-based learning is implemented to cover abusive cases and recognize some characteristics of abusers and victims. Other learning strategies, such as learning by disturbing and game mechanisms, will be explained in Section 3.3.2 and 3.3.3, respectively.

Regarding the design of scenarios and dialogues, it is important that this task goes according to the content defined in the previous steps. Figure11 illustrates the dialogues, emotional expressions and the scenarios designed.

Dialogues and body language



Figure 11.- A fragment of the case for sexual abuse

When creating the reinforcement activities (test, feedback, and hints), some gamification elements are combined with other learning strategies to ensure children understand the content or develop a required skill. Examples of these activities are tests and crosswords puzzles. In Figure12, we note the action corresponding to the mini-test with its feedback.

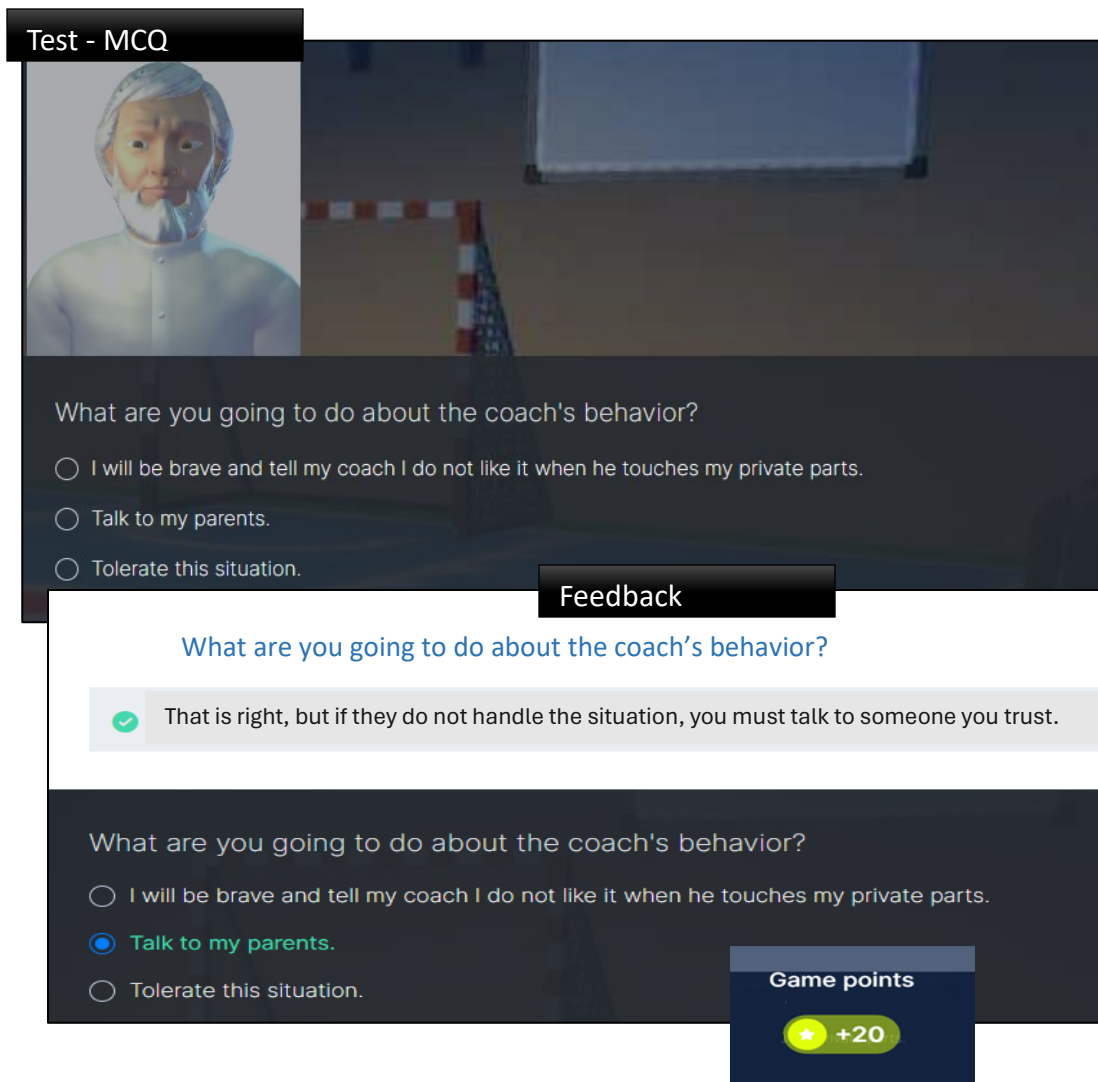


Figure 12.- Example of reinforcement activity

The content definition is a key part in the design of a Serious Game, in particular when the target audience show particular competences. The next step in the design process corresponds to define the structure of the game, which is detailed in the next section.

3.3 Components of ZeroAbuse

ZeroAbuse is designed under four main pillars: Knowledge module, learning methods, game mechanism and administrator module, which must be integrated to effectively accomplish the learning objectives without losing the audience's interest. In section 2.5 some criteria to design SGs were reviewed to achieve the effectiveness and attractiveness of the SG (Caserman *et al.*,

2020; Nilsson *et al.*, 2020) and their recommended pedagogical and entertainment features were taken into account as a framework to build ZeroAbuse. In Figure 13 the components of the ZeroAbuse SG are shown, and they are explained in detail in the next sections.

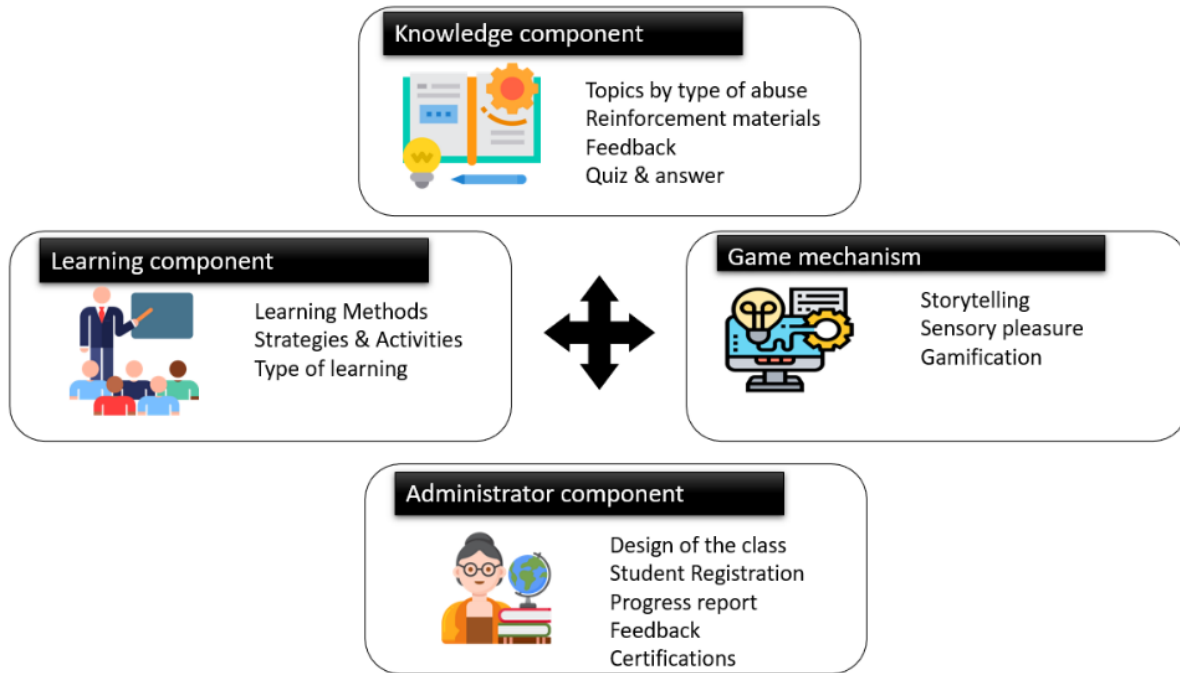


Figure 13.- Principal components of the Serious Game

3.3.1 Knowledge Component

This component contains all the topics that will be taught and designed, based on the methodology explained in Section 3.2. The main objective is to empower children, between the ages of 9 and 11 years old, to recognize different forms of abuse in order not to tolerate any situation of abuse and take actions to prevent it. So, the topics to cover are the definition of abuse, its classification, extending the examples of types of abuse, and providing a protection policy. Figure 14 provides a global perspective of the topic.

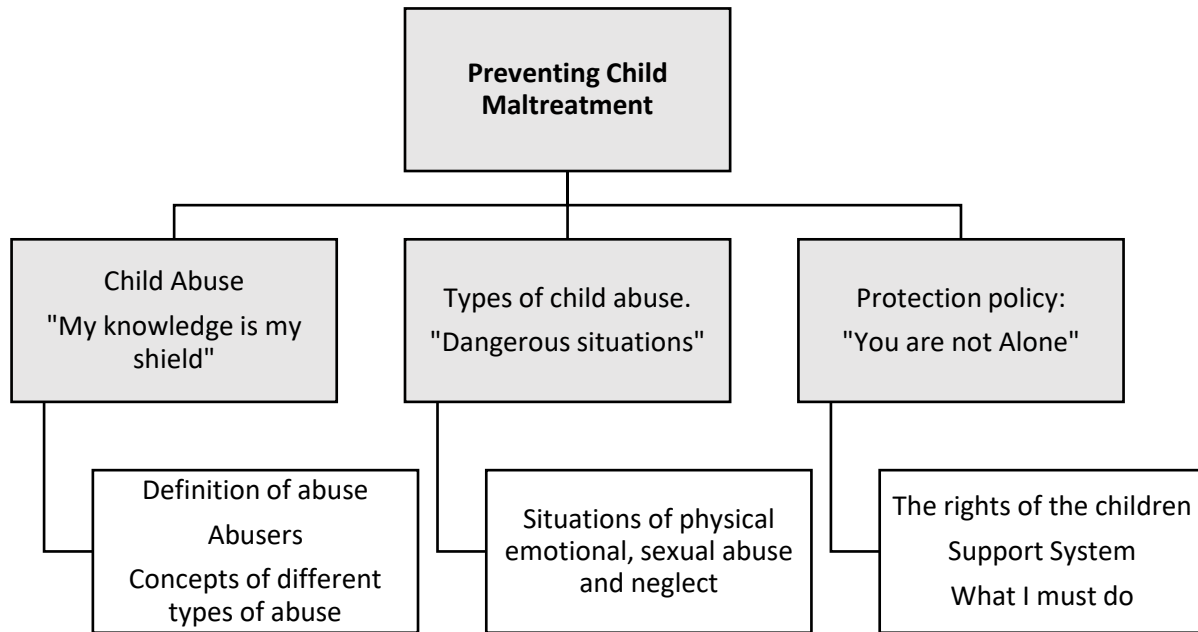


Figure 14.- Topics in ZeroAbuse

The content in the SG was organized by levels. The first level contemplates what abuse is and its forms. Then, each next level corresponds to each type of abuse. Based on the results obtained by Algorithm 1 described in Section 3.2.2, the order of the topics is: Neglect, Emotional, Physical and Sexual abuse. In Table 8 the cases regarding abusive behavior are presented. The cases developed reveal the profile of the abuser, the behavior of the victim and the abuser, the tactics used by the perpetrator, signs or symptoms of victims, and the environment where this usually occurs. The elements described are essential to be covered in abuse prevention(Finkelhor, 2023).

In the Sexual abuse level, private parts are covered in the SG. This definition is essential when we talk about sexual abuse (Tutty, 1995). Also, the serious game proposed incorporates support mechanisms such as the rights created to protect children, guidelines to disclose the problem and resources where kids can find help, support or emergency assistance inside Canada.

Table 8.- Cases by type of abuse in the Serious Game

Type of Abuse	Cases of abuse developed
Neglect	Malnutrition. Inappropriate health care. Inadequate tasks not suitable for children’s physical abilities.
Physical	Severe punishments from parents. Physical bullying.
Emotional	Threatening to harm a child. Exposure to family violence. Putting a child down due to physical disabilities.
Sexual	Fondling. Exposing children to adult sexuality.

Once the concepts are defined, these topics are taught through learning methodologies and strategies that are developed in the next section.

3.3.2 Learning Component

There are criteria that highlight the importance of keeping the focus of the game on the learning objectives. The mechanisms and activities must help achieve these characterizing goals (Caserman *et al.*, 2020). Also, other criteria emphasize that the methods must be appropriate for the target group considering their physical and cognitive skills (Nilsson *et al.*, 2020). Therefore, the corresponding learning method and strategies selected to teach and support the learning objectives are explained here.

Among the methodologies that consider the subject to teach and the player’s characteristics, is *problem-based learning*. *Problem-based learning* is an active learning methodology that involves situated cognition, constructivism, social learning, and communities of practice elements. It forces the students to address real-world problems using higher-ordered thinking. Using realistic context, it helps students be active, emphatic, and responsible citizens with experience in tackling realistic problems. The analysis, communication, formulating ideas, and reasoning are skills involved (Hmelo-Silver, 2004; Orey, 2010). This methodology allows for dissemination and internalization, instead of simply relying on memorization. A set of sequential stages is designed using this methodology, as seen in Figure 15. Such sequence repeats for each type of abuse.

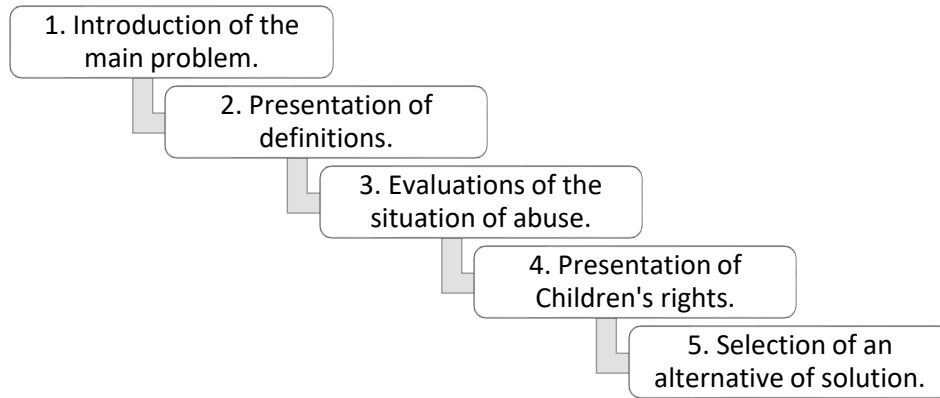


Figure 15.- The flow for each level of the Serious Game

In this sequence, the players face situations where they must evaluate if it is a case of abuse or not. While the players progress in the game, definitions and hints are given as tools to recognize if this situation is dangerous and identify its pattern and characteristics. Also, the consequences of abuse and the profile and behavior of the abuser must be identified. After the evaluation of the abuse, the children’s right is presented. Finally, they have to evaluate some alternatives to provide advice regarding how to deal with this dangerous situation.

There are different types of learning in education such as visual learning style, auditory, kinesthetic, and reading/writing. When sharing knowledge, it is essential to consider using a variety of activities that cater to different types of learning. This approach can help ensure that most students are able to assimilate the content effectively. Short videos (Almeida & Almeida, 2016) and graphic visual elements are tools available for this purpose (Wolfe, 2001). The policy system will be addressed through short videos, meanwhile definition, storytelling and feedback employ graphic visual elements and spoken text. Gamification is an emotional didactic strategy in the teaching and learning process that uses game principles and game elements in a non-game context (Schöbel *et al.*, 2019; Deterding *et al.*, 2011). Also, it is considered a persuasive technology that leads to positive behavior changes (Chalco *et al.*, 2015) that improve students’ performance through a sense of competition (Heidmann, 2015). In Game mechanism, section 3.3.3 its elements will be detailed.

Learning by disturbing is a learning strategy that makes the student question his own decision or opinion by receiving correct or incorrect information. This technique forces the student to

understand the knowledge acquired, so they can evaluate and argue their own decisions. This strategy evokes different levels of thinking such as comprehension, evaluation and argumentation (Aïmeur et al., 1997; Frasson & Aïmeur, 1996). This strategy is used to reinforce the concepts of neglect and emotional abuse.

To improve the children’s content retention on child abuse, the SG incorporates activities based on learning strategies. The activities consider that children between 9 to 11 years old can solve concrete problems, generate their own ideas and have an adequate reading comprehension. Activities such as *evaluate situations, crossword puzzles, select the correct answer, provide suggestion about a case of abuse* are considered in the game. Also, these activities are adapted to obey the criteria described by authors in (Nilsson et al., 2020), which mentions that the reading has to contain few words, the instruction must be short and clear, the interface should be intuitive, and the activities must be limited by the cognition and physical abilities of the target audience.

In addition, a framework for Serious games conducted by (Lim et al., 2013) highlights the connection between the game mechanics and pedagogical elements based on learning theories. The study shows that through low-level game mechanics, high levels of thinking can be achieved. Table 9 shows the level of thinking skills according to the game mechanisms designed in ZeroAbuse.

Table 9.- Thinking skills related to learning and game mechanisms designed in ZeroAbuse

Thinking skills	Game mechanics	Learning mechanism
Evaluating	Actions points, Assessments, Rewards/Penalties.	Assessment, Incentive, Motivation, Reflect/Discuss.
Analysis	Feedback, Realism.	Analyses, Experimentation, Feedback, Observation.
Applying	Competition, Movement, Selecting/ Collecting.	Action/Task, Competition, Imitation.
Understanding	Question and Answers, Tutorial.	Question and Answers, Tutorial.
Retention	Cut scenes/Story, Goods/Information.	Explore, Guidance, Repetition.

Adapted from “*The LM-GM framework for Serious Games Analysis*” by Lim et al., 2013.

Teaching and reinforcement methods must be supported by the design of game elements that play a significant role in the knowledge assimilation. These elements are part of the Game Mechanisms that will be covered in the next section.

3.3.3 Game Mechanism

Being engaging, enjoyable and fun are characteristics that a serious game must include (Koster, 2005, Nilsson *et al.*, 2020). Teaching children and keeping their attention simultaneously is a hard task, but Game experiences (GX) help the game meet both objectives using some elements in the game's flow. Storytelling, gamification, combined learning strategies and feedback are examples of these elements (Dörner *et al.*, 2016, Sweetser & Wyeth, 2005). Sensory stimulations, visual and audio also maximize the experience, and through appropriate background music, sound effects and graphics, the player will feel emotionally involved in the game (Caserman *et al.*, 2020; Nilsson *et al.*, 2020).

Storytelling. Using a story or narrative facilitates quick comprehension and helps in remembering the information (Abma, 2003; Behmer, 2005). Also, it creates a connection with the learning objectives and keeps the children more motivated (Caserman *et al.*, 2020; Nilsson *et al.*, 2020). For that reason, the topic is covered through storytelling.

The story is about Nicolas, a kid who migrates to another country. While he discovers the new neighborhood and makes new friends, he learns that his friends are living in situations of abuse, and they learn what to do with the guidance of Nicolas's grandfather. Walking through the park, Nicolas meets Mary and realizes that she cannot play as she would like due to malnutrition. After his first day of school, his friend Adam reveals a burn on his skin from a punishment given to him by his parents. Continuing with his daily activities, during a visit to the museum, Nicolas sees how his friend is threatened with being beaten if he does not give in to the demands of another child. At the end, Nicolas also becomes a victim of abuse and must practice what he has learned.

The sensory pleasure is present to make an enjoyable game using the soundtrack, 3D characters, vivid color palette, and nice visuals (Dörner *et al.*, 2016).

Gamification. Using game elements or methodologies to non-games gives a sense of competency that engages the student (Deterding *et al* 2011). Rewards, badges, feedback, leader's boards and ranks are examples of game elements.

Rewards. A positive reinforcement to a desired action or accomplished tasks. It lets the players immerse in the game (Desurvire & Wiberg, 2009). Gaining points, virtual badges, achievements, power-ups and desirable objects are examples of rewards. Gaining points is the most common element used and it lets students compare their performance against others (Caserman *et al.*, 2020; Dörner *et al.*, 2016).

Leaderboard. Allows the players compare their scores. Their objective is to motivate and engage the player in learning activities. A visible leaderboard stimulates the player to complete the game while trying to minimize the number of mistakes made in order to reach the top of the list (Park & Kim, 2021).

Feedback has a positive impact on learning outcomes (Johnson *et al.*, 2017) and it provides guidance to players about their progress through the correction of their answers throughout the learning process (Shute, 2008). The feedback must be continuous and visible while the players progress in the game to motivate them (Caserman *et al.*, 2020; Nilsson *et al.*, 2020). Also, the presentation of the feedback must be in different formats (Desurvire & Wiberg, 2009). The game provides conceptual information immediately, then the players give their answers and the correction is presented using text based and spoken feedback (Nilsson *et al.*, 2020).

Finally, the last module of the Game is explained in the next section.

3.3.4 Administrator Module

Most prevention programs encourage educating the community and incorporating these programs into educational institutions increases the coverage radius (Jones *et al.*, 2020; Public Health Agency of Canada, 2019). Some effective features of prevention programs to address sexual abuse are: *Standardized materials* and *Integration into school's curriculum* (Scholes *et al.*, 2014). *Standardized materials* refer to the fact that programs are more effective if the material is

taught by a trained instructor. *Integration into the school's curriculum* indicates that the programs are more effective if they are integrated into the school within specific periods of time for support.

For that purpose, an administration module is considered to let the schools, or any center for prevention, manage the student's information or set the roles of administrator or instructor. Regarding the class, this module lets the instructor configure the class, see the progress of the students and works as communication channel between the instructor and the students. According to Caserman *et al.* (2020) and Nilsson *et al.* (2020), providing appropriate feedback and awards are important criteria. This module allows instructors to track the performance of their students and address any concerns. Additionally, it enables the generation of awards or certificates upon completion of the course.

This chapter introduced the main components included in the design of the Serious Game. These components provide the framework to effectively achieve the learning goals and keep the children interested. The next chapter outlines the implementation of the proposed Serious Games.

Chapter 4. Implementation

This chapter describes the implementation of the components that define the structure of the serious game.

After defining the design, contents and components, the concept is transformed into a reality. Gamelearn, a game engine for independent game developers, was selected to implement the project. Gamelearn authoring tool is a platform dedicated to creating serious games; it is known in the educational and commercial sectors. This platform lets us turn the learning content into an immersive experience for children. Through a game editor, the four components of ZeroAbuse can be merged. Vast elements are available to create real game-based learning experiences, such as a wide range of scenes, 3D designs of characters and objects and games' mechanisms that allow to develop ZeroAbuse with the features and criteria defined in the section 3.3. Also, for the designer, the platform provides other resources such as a support team and tutorials.

The integration of ZeroAbuse's knowledge, learning component, game mechanism, and administrator module, is illustrated in the flowchart shown in Figure 16. This diagram provides a visualization of the implementation.

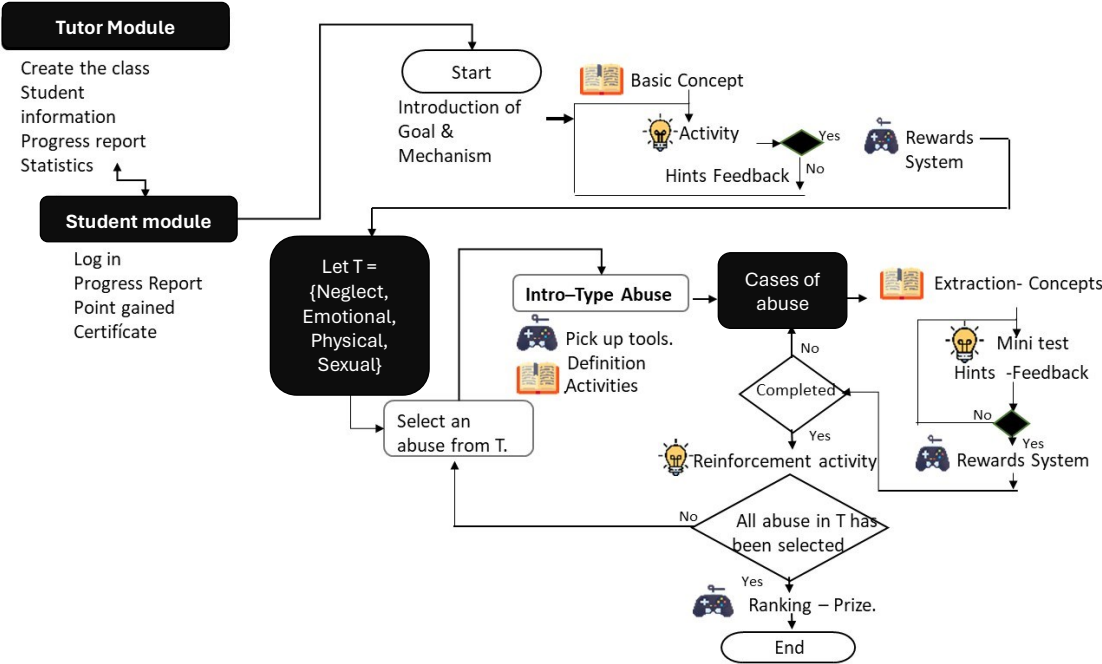


Figure 16.- Flowchart of the Serious Game

ZeroAbuse’s flowchart in Figure 16 shows the Tutor module and Student module. The **Tutor module** lets the serious game be incorporated into the school or prevention center’s curriculum. The qualities of effective prevention programs highlight the importance of incorporating it in educational institutions for support (Scholes *et al.*, 2014; *Violence and Abuse Prevention - Canadian Red Cross*, n.d.). The main purpose of the module is to allow the registration of institutes and enrollment of students, as well as organizing classes and providing statistics on students’ performance. In Figure 17 the menu for the Tutor module of ZeroAbuse is displayed. The main menu contains the following options: *Clients*, responsible for registering the institution or organization; *Classes*, where the classroom is created and scheduled; *Students*, where the student’s information is registered; *Campus*, stores the course created; and *Reports*, in which the administrator can generate reports regarding the progress of the students. **The student module** is a representation of a student in the system. It encompasses personal information such as name, institution affiliation, e-mails, and the progress report of the course and the points, ranking, and certificates obtained.

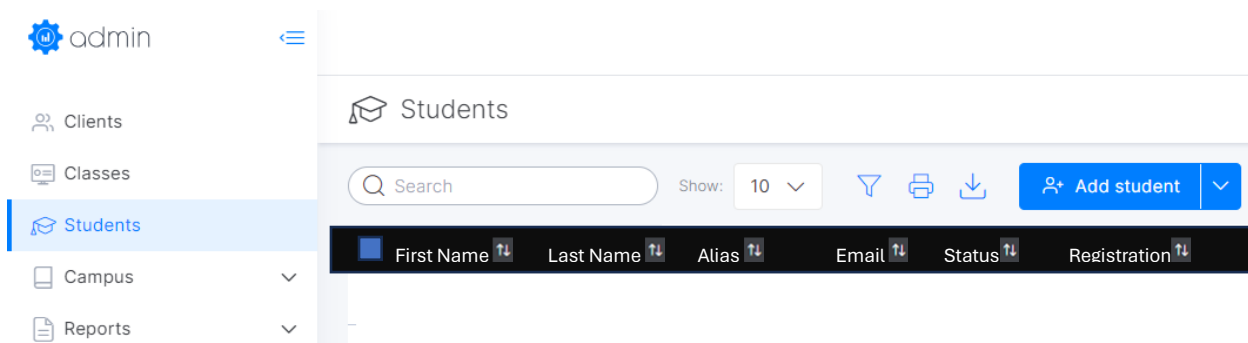
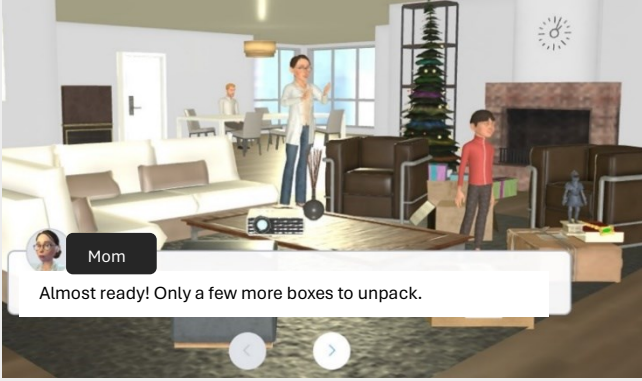




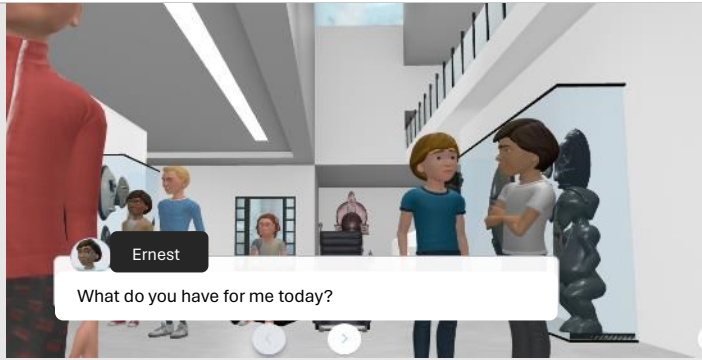
Figure 17.- The menu of Tutor Module

The Gamelearn platform combines the knowledge and learning module and the game mechanism to accomplish the requirements and preferences of children from 9 to 11 years old. The storytelling, detailed in Section 3.3.3, encapsulates the content. The game contains five levels: The first level corresponds to the introduction of the abuse, and the remaining levels correspond to each type of abuse. Each type of abuse is developed through situations involving the main character, Nicolas, and his friends. In Figure 18, the scenes and topics by each level are shown.

Gamelearn enhances the overall experience by enabling the integration of 3D characters, backgrounds, and scenarios with a palette of vivid colors into the game. There are features that allow the immersion in the story such as: animation when the character interacts, expressions of emotion, soundtracks, etc. Spoken and written dialogues and control of the dialogue's pace are other features to personalize the game to the different types of learners. In Figure 18, the features mentioned are shown.

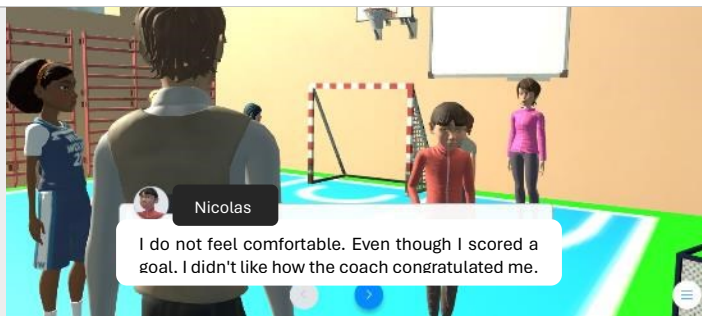
<p>Level 1- Introduction of Child abuse</p>  <p>Mom Almost ready! Only a few more boxes to unpack.</p>	<p>Nicolas has to go to another country and he will encounter some situations of child abuse while he discovers the new neighborhood.</p>
<p>Level 2- Type of abuse: Neglect.</p>  <p>Introduction The next day you decide to go to the park and make friends.</p>	<p>Walking through the park, Nicolas meets Mary and realizes that due to malnutrition, she cannot play as she would like.</p>
<p>Level 3- Type of abuse: Physical abuse.</p>  <p>Teacher Good morning guys! We have a new friend with us, his name is Nicolas.</p>	<p>Later, in his first day of school, his friend Adam reveals a burn on his skin from a punishment given by his parents.</p>

Level 4- Type of abuse: Emotional abuse.



Nicolas sees how his friend is threatened with being beaten if he does not give what another guy is demanding.

Level 5- Type of abuse: Sexual abuse.



At the end, Nicolas is a victim of abuse by his coach and must put in practice what he has learned.

Figure 18.- Levels and scenes of ZeroAbuse

To accurately understand the material, the learning methods and strategies detailed in section 3.3.2 were implemented. The introduction of the main problem, the presentation of definitions, evaluations of the situation of abuse, the presentation of children's rights and the selection of an alternative solution, are steps that constitute the main core loop of the game guided by Problem-based learning method.

In the flow of the game, the player starts with the introduction of the main character's story, presentation of the learning and games objectives, the introduction of Child abuse as well as the mechanism of the games. For each type of abuse the players face situations where they must evaluate if such situations correspond to a case of abuse or not. While playing the game, definitions and hints are given as tools to help recognize if the situation is dangerous and identify its pattern and characteristics. Also, the player must identify the consequences of abuse and the profile and behavior of the abuser. Finally, the players have to evaluate some alternatives to provide advice regarding how to deal with the dangerous situations.

The learning activities described in section 3.3.2 were implemented as mini-games to reinforce concepts. They were introduced after the presentation of the content or abuse behavior cases as we can see in Figure 16. For example, the learning by disturbing strategy (argumentation) is implemented by using Nicolas' cousin as an intruder. During the game, the cousin provides his opinion when the player is asked to select an answer. However, the cousin's opinion is not always correct, and the player needs to understand the concept to avoid being influenced by false information. Other activities implemented to support the content are shown in Figure 19.


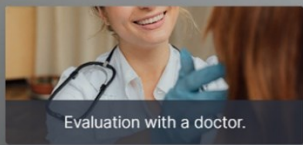
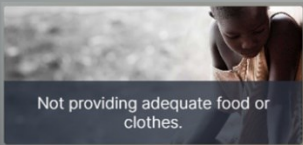
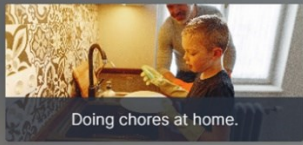
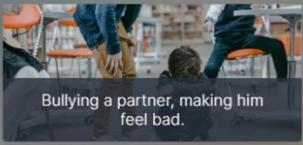

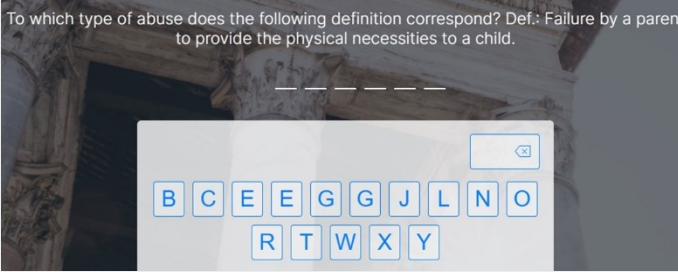

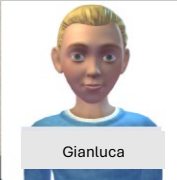
<p>Evaluation of situations</p>  <p>His mother asks him to go to his room with his brother meanwhile she tries to defend herself from her husband.</p>	<p>Selection of answer</p>  <p>Evaluation with a doctor.</p>  <p>Not providing adequate food or clothes.</p>  <p>Doing chores at home.</p>  <p>Bullying a partner, making him feel bad.</p>
<p>Provide suggestions or opinions</p>  <p>2. Write the ending that you would give to the siblings</p>	<p>Crossword puzzle</p> <p>To which type of abuse does the following definition correspond? Def.: Failure by a parent to provide the physical necessities to a child.</p> <p>_____</p> 
<p>Pick up and drop off objects</p> 	<p>Argumentation</p>  <p>Gianluca</p> <p>Cousin, let me tell you my opinion before you make your final decision. She wants to help her mother because her mom needs it, but your friend can hurt herself and her little brother. She is too young for this responsibility.</p>

Figure 19.- Learning strategies implemented in the Serious Game

The game's flow continues with the implementation of Gamification elements such as rewards, badges, feedback, etc. Such elements appear after some activities or mini-games in the SG. As mentioned in Section 3.3.3 the idea is to engage players into the game.

Rewards. In the game, performance metrics such as the number of accurate answers, completed actions, or finished readings are utilized. The player is given 20 points for each right answer, whereas the same number of points is subtracted if a wrong answer is provided. Upon completion of either tasks or readings, 10 additional points are added. These performance metrics are presented at the top left of the main screen as well as in the menu of ZeroAbuse. Figure 20 depicts an example of the performance metrics in the leaderboard screen.

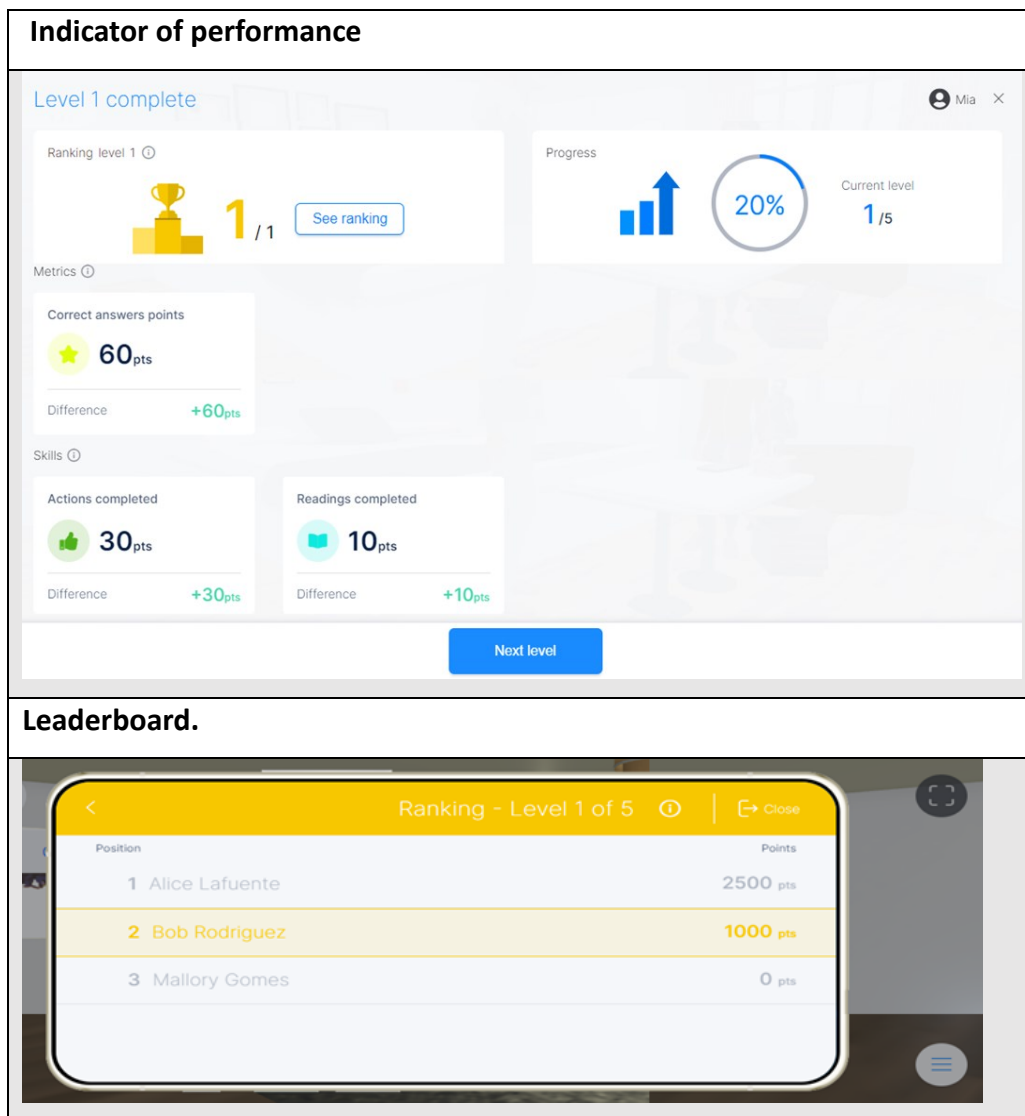


Figure 20.- Rewards implemented

Game's Menu. ZeroAbuse incorporates a drop-down menu with five options. The first option lets players exit the game at any time, the second is reserved for communication while the third one corresponds to audio, image and multimedia settings. The fourth, "Phone notes", stores the materials provided in the game to check them or download when the player needs them (Notepad, Skill, Rankings). The last option lets the players store the picked-up objects. The main menu and the options in the "Phone Notes" submenu are presented in Figure 21.

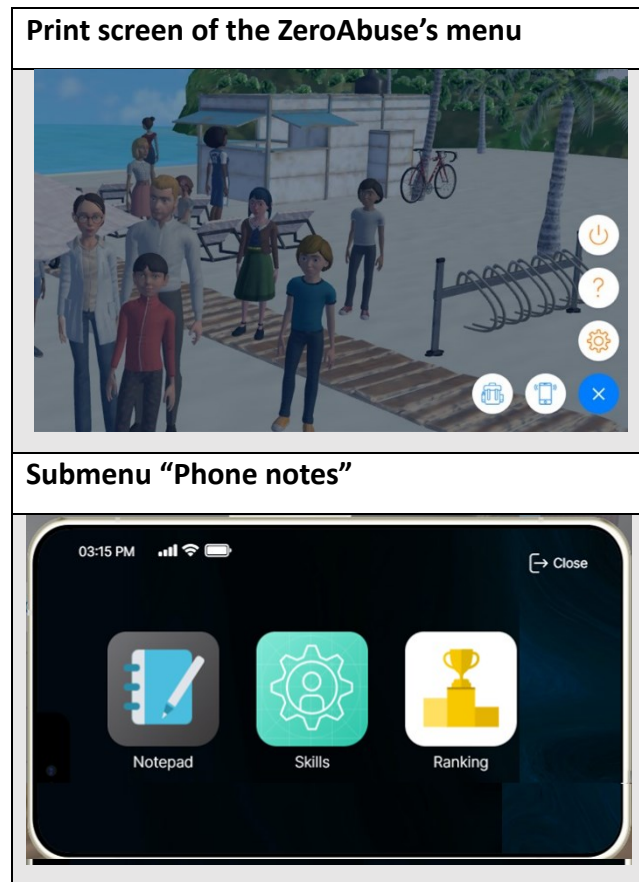
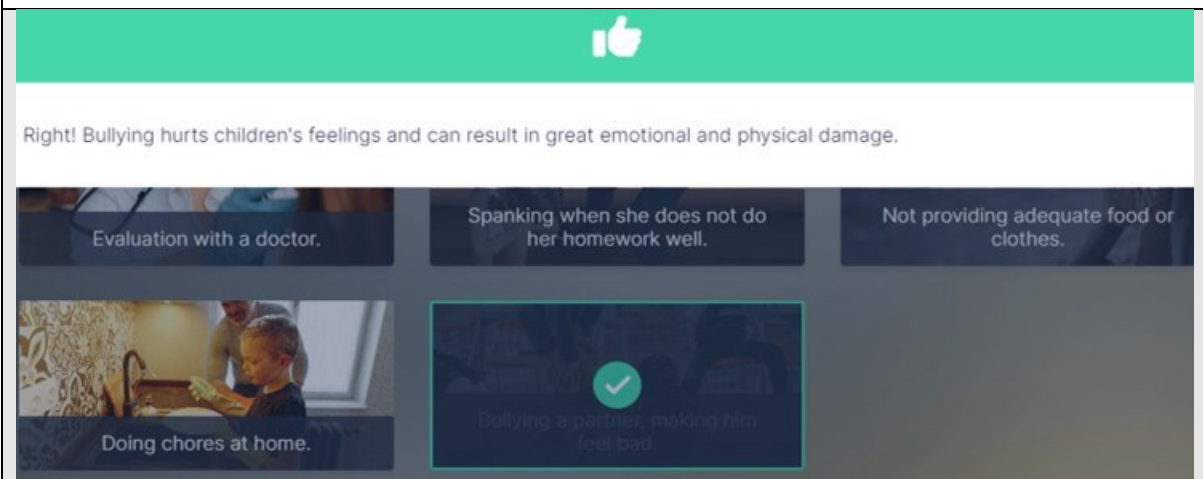


Figure 21.- The Serious Game Menu

Feedback. This is a key element that supports the learning objectives, provides guidance to players about their progress through the correction of their answers and motivates students. In ZeroAbuse, the spoken and written feedback is given for both correct and incorrect answers. During the game, feedback is constantly provided. The feedback is always visible and uses different formats including text, icon or a character of the story. Examples of feedback are illustrated in Figure 22.

Support the correct answer




Right! Bullying hurts children's feelings and can result in great emotional and physical damage.

- Evaluation with a doctor.
- Spanking when she does not do her homework well.
- Not providing adequate food or clothes.
- Doing chores at home.
- Bullying a partner, making him feel bad.**

Correction

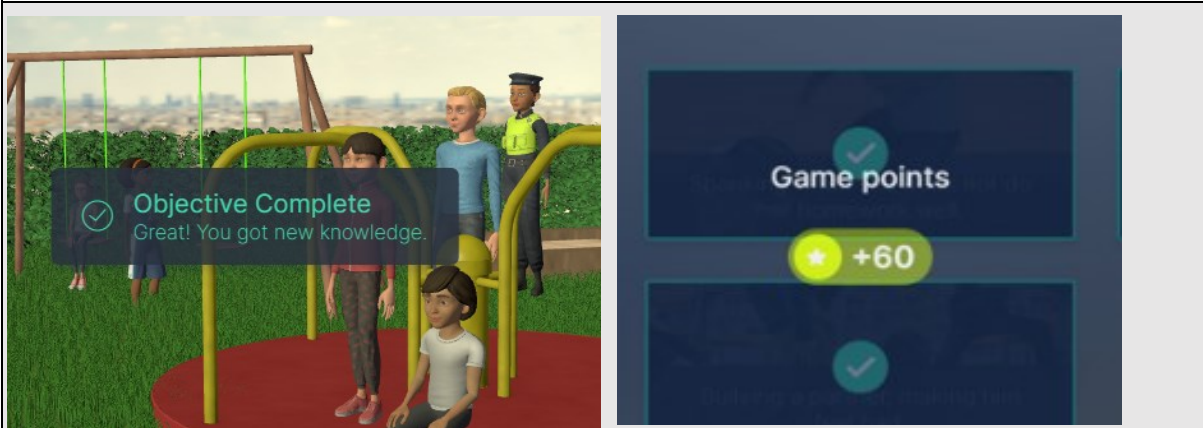
Feedback

 Remember, being exposed to violence is an emotional abuse. He is in danger because his father could be aggressive with him. So, he needs to ask for help and insist until he feels safe.

Action

- Yes, I agree. He should talk about this problem.
- No, I do not agree. He should not reveal this problem.**

Motivational feedback



Objective Complete
Great! You got new knowledge.

Game points
+60

Figure 22.- Examples of feedback implemented in the Serious Game

The game ends once all the levels are completed. Finally, for a proper performance of the game, on tablets or computers, a minimum of 4GB RAM is required. In addition, as the SG is an online game, it requires a 80Mbps internet connection.

The first phase of the project has been successfully concluded, allowing for the next stage of assessment by external parties, including the target audience, who were not part of the initial design phase.

Chapter 5. Evaluation

This chapter presents the evaluation of the Serious Game conducted by experts, who were not involved in the design process, to improve the game. In addition, it showcases the mechanisms used for evaluating the impact of the Serious Game on children. Furthermore, the results of the evaluation are discussed.

5.1 Evaluation of ZeroAbuse's Components

Serious Games are created to reach at least one characterizing goal and to entertain (Dörner *et al.*, 2016). In the case of ZeroAbuse, its design encompasses components that ensure learning without losing the attention of children. But, in order to enhance the game and measure its impact, an evaluation guide provided by the authors in (Caserman *et al.*, 2020) was used. This guide highlights significant factors to consider to achieve the balance between “Learning” and “Entertainment”. In serious games, there are two distinct components: the serious aspect, which aligns with the learning objectives, and the game aspect, which comprises game experiences (entertainment). To properly assess the game, a two-part evaluation was conducted. The first part corresponds to the evaluation of the Serious aspect, led by domain experts who work in prevention centers. The second one refers to the game aspect, that was managed by a team comprised by computer science students. Finally, the effectiveness of ZeroAbuse was evaluated by children aged 9 to 11 years old. In Figure 23 the evaluation process is shown.

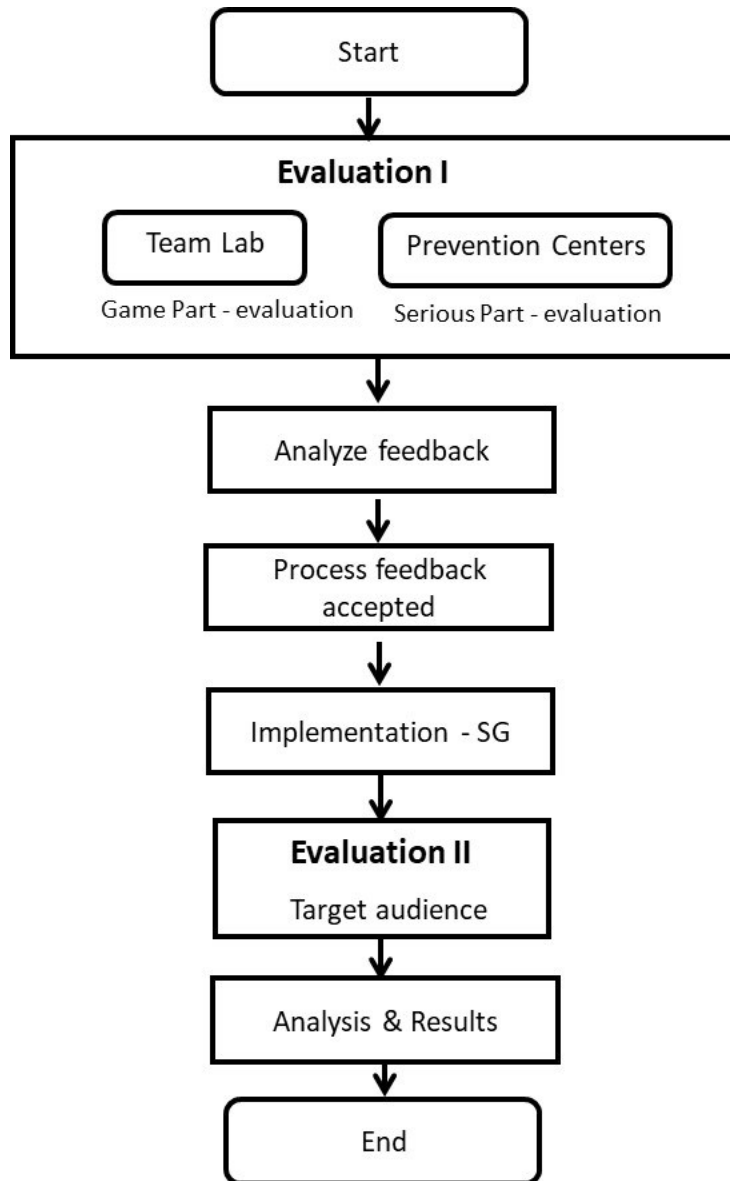


Figure 23.- The evaluation process

The next section focuses on the evaluation of the game part of the Serious Game.

5.1.1 Evaluation of The Game Part

The authors in (Caserman *et al.*, 2020) have identified core elements that allow players to optimize their gaming experiences. To make a game engaging, enjoyable, and fun, it must possess desirable characteristics such as enjoyment and media presentation. Table 10 provides the explanation for both enjoyment and media presentation.

Table 10.- Quality criteria to evaluate the game part

Quality criteria	Explanation
Enjoyment	Ensures player engagement and experience. Awareness of different player types. Ensures flow. Sense of control, the result depends on their actions. Includes multimodal sensory stimulation: visual, audio, haptics, smell.
Media presentation	Attractive graphics and appropriate sound effects.

Adapted from “Quality Criteria for Serious Games: Serious Part, Game Part, and Balance”, by Caserman *et al.*, 2020.

A focus group was carried out as part of the evaluation process. To this aim, sixteen Computer Science Master's and Ph.D. students who have expertise in the field were part of the focus group. The corresponding process of evaluation is detailed below.

Process to evaluate ZeroAbuse – The game part

Step 1: Present the purpose to the focus group.

Step 2: Register in the ZeroAbuse SG. In this step, access to the game is granted by setting the class and the time to start and end.

Step 3: Receive the feedback.

Step 4: Validate if the suggestions can be incorporated into the game.

Step 5: Implement the approved changes.

Step 6: Second meeting to show the new version of ZeroAbuse and answer any concerns.

The insights obtained from the focus group are summarized in Table 11 according to the enjoyment and media presentation criteria.

Table 11.- Results of the evaluation of the game part

Criteria	Results
Enjoyment	The evaluation of the case of abuse is repetitive. It would be great to use the keyboard when writing is needed. The feedback message should disappear automatically. The menu icons must be bigger. The place where indicators appear must be consistent along the game.
Media presentation	The characters in 3D and the animation of the personage give a sense of realism. The sound that indicates that something is wrong awakes the emotional sense. The sound is appropriate to actions or scenarios. The brightness of colors is appropriate for children.

Several changes to the game were accepted, but some were rejected as the current setup was specifically created to fulfill the game's objectives. One suggestion proposed automatic disappearance of feedback, but it may not be the most suitable approach. Adopting the suggested method cannot guarantee that every child has had sufficient time to read and understand at their own pace. One way to encourage children to read the feedback is by prompting them to close the feedback window. Another observation suggested that the game shows a repetitive evaluation of cases of abuse, but the purpose of this SG is to expose children to several cases for type of abuse, so they can clearly identify them.

5.1.2 Evaluation of The Serious Part

The quality criteria used to evaluate the serious part are shown in Table 12. The criteria of serious part mention the importance of how the concepts, methodologies, activities of reinforcements such as minigames, feedback, rewards systems, and test must support the learning objectives. To examine whether ZeroAbuse's design and implementation prioritize these core criteria or not, prevention centers were invited as evaluators. Two prevention centers accepted to be part of this process: The Canadian Centre for Child Protection, a national organization dedicated to the personal safety of all children, with more than 30 years of experience, and Marie-Vincent, an organization specialized in the prevention of sexual abuse. We will refer to the Canadian Centre for Child Protection as Organization I, and Marie-Vincent will be Organization II.

Table 12.- Quality aspects for the serious part

Quality aspects	Explanation
Focus on the characterizing goal	Learning/training goals must remain in focus, for which a combination of physical and cognitive training can be beneficial. Support players to achieve the characterizing goal. Game elements should not interfere with the learning/training process.
Clear goals	Appropriate methods for the specific application area and target group. Goals are clear and appropriate so that players can work towards the characterizing goal.
Correctness of the domain expert content	Avoid errors and ensure that the content is technically correct. Ensure correct technical language. Remain neutral, especially on political and social issues.
Appropriate feedback on progress	Players should receive feedback on their performance and progress. Visible and recognizable effects. Provide simultaneous feedback.
Appropriate rewards	Provide positive reinforcement and in-game awards.
Proof of effectiveness & sustainable effects	Prove that the characterizing goal is achieved. Learning/training effects need to be sustainable.
Awards and ratings	Game awards, professional and user ratings, recommendations by domain experts, game reviews, and number of players/downloads state the quality of the game.

Adapted from “Quality Criteria for Serious Games: Serious Part, Game Part, and Balance”, by Caserman *et al.*, 2020.

While the individuals involved in this process are affiliated with the organizations mentioned, the evaluation cannot be signed on behalf of the institutions due to policy constraints. Hence, the comments and suggestions provided were made as individuals. The process used to evaluate ZeroAbuse is described below.

Process to evaluate ZeroAbuse - The serious part.

For each organization.

Step 1: Present the purpose of the interview to the members.

Step 2: Register in the ZeroAbuse SG. In this step, access to the game is granted by setting the class and the time to start and end.

Step 3: Explain the instrument of measurement. The measuring instrument contains open-ended, ordinal scale and divergent questions (See Appendix B).

Step 4: Discuss the feedback and evaluation received.

Step 5: Validate if the suggestions will be accepted.

Step 6: Implement the approved changes.

The quality criteria gathered by the authors in (Caserman *et al.*, 2020) was adapted in an instrument to evaluate the game. In section 3.1.1, the learning objectives were outlined. A discussion question was posed to evaluate the clarity and feasibility of the learning objectives for the target population. This discussion considers the evaluator's experience. Two forms were designed to capture their point of view regarding the serious aspect of the game. The two forms are detailed in Appendix B.

The Form No. 1 lets us evaluate the following criteria, shown in Table 12: Focus on the characterizing goal, correctness of the domain expert content and evaluate the appropriate feedback on progress and rewards. After discussing the objectives, Form No. 1 is provided to collect information about the content displayed in the application. The form included open-ended questions about the clarity and quality of the lessons, the reinforcement material provided, and the feedback and hints given for each level. This form must be filled out while they play.

The Form No. 2 uses ordinal scale questions and lets us evaluate the Proof of effectiveness and sustainable effects criteria and whether the game elements interfere with the learning process. It does so by examining narrative content, structure, and playability. This form includes Likert-scale questions that collect feedback on whether the story is engaging and if the mini-activities support the learning objectives or not.

According to the quality aspects outlined by (Caserman *et al.*, 2020) the results obtained by the employees were summarized by organization. Table 13 shows the results for Organization I.

Table 13.- Results of the evaluation of the serious part – Organization I

Quality aspects	Observations
Characterizing Goal – Learning Objectives	<p>The learning objectives are clear and achieved.</p> <p>The learning objectives were developed in the correct way.</p> <p>The activities are simple and support the learning objectives.</p> <p>The game elements introduced support the goal.</p> <p>The first scene where the family is unpacking does not contribute to the objective and consumes time.</p> <p>The game's development reflects its learning objectives.</p>
Methods and Strategies used	<p>Instead of having the player write the type of abuse, the activity could be replaced with multiple-choice questions.</p> <p>The activity where children read news articles and provide their opinion reinforces the sense of empathy.</p>
Correctness of the domain expert content	<p>Suggest using more colloquial expressions.</p> <p>In support system eliminate National Child Abuse Hotline and Emergencies call 811 and incorporate Kids Help phone: 1-800-668-6868.</p> <p>Suggest to change the title of emotional abuse for Psychological.</p> <p>Neglect is not providing healthy food. It refers to food in general.</p> <p>In Canada, it is considered negligent when children are deprived of an education that hinders their development.</p> <p>Sending children to school is optional.</p> <p>Rearrange the order the rights are presented.</p> <p>Eliminate the words “Have to”, “Must” in all the game because children should not be forced to do something or act in specific ways.</p> <p>Eliminate the case of Gabriel Fernandez, this is a traumatizing case for children but keep the activity where the child must give his point of view.</p> <p>The topic of private part is an old concept that must be eliminated of the game, nowadays children have to know that all their body is private.</p>
Appropriate feedback on progress	<p>Getting feedback on whether an answer is right or wrong is an excellent way to reinforce newly acquired knowledge.</p>
Appropriate rewards	<p>The game has positive reinforcement.</p>
Proof of effectiveness & sustainable effects	<p>The examples provided for each type of abuse are adequate.</p> <p>In physical abuse, two students do not seem like children.</p>
Awards and ratings	<p>They suggest to show all these indicators in the same place.</p> <p>Let the players know that they can access and download the documents by clicking on the cell icon.</p>

To determine the level of agreement or disagreement for a series of features, a ten-level Likert scale was utilized. The scale ranges from 0, indicating strong disagreement, to 10, indicating strong agreement. The game's outcomes are shown in Table 14.

Table 14.- Score - Organization I

Features	Score
The story engages the children	7
The story supports the learning objectives	7
The language is appropriate for children (9-11)	5
The lessons are easy to understand	8
The lessons are well written	7
The information is useful	10
The mini-activities support the learning objectives	7
The player knows what they need to do all the time	4

After receiving feedback from the organizations' employees, some modifications were made to the game to incorporate their suggestions. Some of the suggestions that were approved as being particularly relevant include: reviewing the language used and adopting a more colloquial style, altering the case of Gabriel Fernandez, providing useful tools for saving and downloading information after each reminder, removing introductory scenes, and making modifications to two instances of neglect. After the changes were implemented, the SG underwent a second evaluation. The outcome of this assessment can be found in Table 15 and Table 16, as obtained by Organization II.

Table 15.- Result of the evaluation of the serious part – Organization II

Quality aspects	Observations
Characterizing Goal – Learning Objectives	<p>The objectives are well defined and achievable.</p> <p>The definitions for each type of abuse are clear and the examples are useful and relevant, aiding the player’s comprehension.</p> <p>The cases show the concept of secret and privileged attention, which is quite interesting as these are techniques often used by the perpetrators.</p> <p>The context of the story is difficult to follow because the scenario changes frequently. They suggest keeping a few places as scenarios of the story.</p> <p>It would be beneficial to clearly define the learning objectives at the start of the game to ensure that both the player and the adults accompanying the children understand them.</p>
Game elements should not interfere with the learning/training process	<p>When the backpack is clicked, the sound is quite aggressive. Perhaps a softer noise would be more fitting.</p> <p>Information regarding children's rights and how to seek assistance is reiterated at every level, which can make the game seem somewhat repetitive.</p> <p>The current setup only permits one playthrough. Players should have the option to replay levels.</p>
Methods and Strategies used	<p>Teaching children through case studies effectively addresses the learning objectives at hand.</p> <p>The cases for physical abuse are interesting.</p> <p>Sometimes it seems like Nicolas has to solve children’s maltreatment situations by himself. That is a big responsibility for a child.</p> <p>The information regarding children's rights would be such as a static image across all levels.</p> <p>Adding a concluding chapter that includes inquiries about the five distinct forms of maltreatment could be valuable. This would serve as an excellent review.</p>
Correctness of the domain expert content	<p>The lesson content is appropriate for children between 9 and 11. However, the word “evaluate” must be changed.</p> <p>It should not be called sexual abuse when a child younger than 12 years old is the perpetrator. Instead, problematic sexual behavior or sexualized behavior problem are the adequate names.</p> <p>It is necessary to include boundaries in Sexual abuse.</p> <p>In the case of private parts, it is recommended to show the sexual parts. It would be useful that children that point out these parts are naked.</p>
Appropriate feedback on progress	<p>The content Sexual abuse includes significantly complex situations for children aged from 9 to 11, such as exposing a child to pornography.</p>
Appropriate rewards, awards and ratings	<p>It would be nice for the players to have a final prize.</p>

The following table shows the scores given by the workers of this organization. It is worth mentioning that when the evaluators were playing the game, the platform was under maintenance, and it produced some bugs which were solved later. Most of these bugs were related to the development of the scenes, which explains the lower score in the evaluation of the mini-activities and playability.

Table 16.- Score - Organization II

Features	Score
The story engages the children	6
The story supports the learning objectives	8
The language is appropriate for children (9-11)	8
The lessons are easy to understand	7
The lessons are well written	6
The information is useful	9
The mini-activities support the learning objectives	4
The player knows what they need to do all the time	4

This organization is specialized in sexual abuse and their suggestions about including some topics were not added to avoid a much longer game. However, some guidelines were introduced in the game as the result of this evaluation.

Finally, after improving the ZeroAbuse game with the feedback received, the next step corresponds to assessing the game with children.

5.2 Evaluation of ZeroAbuse’s Effectiveness

To evaluate if the learning objectives were achieved by children aged from 9 to 11, paired sample tests were used. The Wilcoxon Signed-Rank test allows for comparing the median between two measures made to the same unit. So, a sample of children is randomly selected and a set of questions is applied before they start playing and the same set of questions is applied again, once they finish. The aim is to get a score about child abuse knowledge before and after the game.

It is worth mentioning that getting children for the test turned out to be a complex task despite the objectives of the video game. Many parents were hesitant about allowing their children be exposed to some statements such as: punishment for education can be considered as violence, perpetrators can be their relatives, and motivating children to be open to talk to other people about their situations. Despite these issues, 12 students participated in the evaluation, where 42% of them were boys and 58% girls.

The questionnaire applied before the children play the serious game is organized in three sections: concepts, examples of child abuse, and assistance programs (Form3). Form 3 lets us evaluate the effectiveness of the game. Meanwhile the questionnaire applied when the players finish the course contains the same sections to assess the effectiveness and adds one section to evaluate the attractiveness (Form 4). Both forms can be seen in Appendix C. To evaluate the effectiveness, a maximum score is defined for the answers provided, which allows for a quantitative measure, denoted by an interval scale variable of 20 points.

The results of Form 3 demonstrate that all of the children in the survey have some understanding of child abuse. However, 55% were unaware of what emotional abuse entails. Furthermore, most players (91%) were not familiar with the meaning of neglect and most of them did not consider situations such as being exposed to family violence or lack of food as forms of maltreatment. When it comes to protection system, most players seek assistance from their parents. However, a staggering 50% of them do not realize that they have the right to report cases of mistreatment or offer support to a friend who is a victim of abuse.

After finishing their game session of ZeroAbuse, the same children were asked to complete Form 4, which aims to gather information on their perceptions of certain features of the game. It was found that the majority of players were captivated by ZeroAbuse, and 90% of the users considered the game to be both enjoyable and user-friendly. Additionally, all of the students mentioned that the knowledge imparted was easy to understand. They noted that the game is beneficial and teaches them about situations they were previously unaware of. Also, they expressed interest in knowing what happened to the children once they reported the abuse to the police.

Comparing the data collected in Form 3 against the data collected in Form 4, it shows that the game helps students understand different types of abuse, because after the game most of the students could provide more than two examples of each kind of abuse (92%). Also, the game provided them with a wider range of support options in case they were in danger. In Form 4, other personages, such as police officers and friends, appear as trusted people, and call 9-1-1 as an option was recognized by 83% of the players. One important change was that students that thought that they were not able to report any case of abuse or not able to help other kids, changed their opinion after playing the game.

The maximum score defined for each evaluation, either before or after students play the game, is 20 points. A positive difference between the scores obtained after and before playing the game indicates that the learning objectives of ZeroAbuse are accomplished. On average, the students got a score of 12 points before playing the game, meanwhile after they played the game, they got a score of 17, on average.

A non-parametric test, such as Wilcoxon Signed test, was applied to support the last statement. The scores on child abuse awareness before and after playing the game were compared. Based on the results of this non-parametric test (p-value 0.00126), it can be concluded that SG effectively enhances children's awareness of child abuse.

The results of the evaluations show that the SG positively impact the learning about child abuse, as better scores were obtained by the students after they played the game. Finally, the next chapter concludes this work and discusses possible future work.

Chapter 6. Conclusion and Future Work

This work proposed the design of a Serious Game focused on the four different kinds of child abuse: Sexual abuse, physical abuse, emotional abuse, and neglect. The target population of this game was children aged 9 to 11 years old.

Unlike existing approaches to prevent child abuse, the SG in this work considers all kinds of abuse. In addition, this SG includes learning approaches and different learning strategies to evoke levels of thinking such as problem-based learning, learning by disturbing, and gamification, which enhance the learning process and children's engagement. It combines guidelines of prevention programs and develops the SG's content according to children's cognitive development. Experts in child abuse prevention enhanced the design process, ensuring adequate concepts, language, and context, adjusting the examples according to Canada's laws and culture. The evidence suggests that the proposed SG helps children learn about child abuse. We found that more than 92% of the students increased their knowledge about different forms of abuse. They also learned several options to help themselves or other children when facing abuse.

However, there were limitations in the testing phase. As the SG was aimed at children in elementary schools, parents' cultural factors represented a strong barrier to playing this kind of SG. Some behaviors illustrated in the SG were depicted as abuse, whereas for some cultures, they are seen as discipline or common routines. Thus, those parents did not allow their children to play the SG. This suggests that future extensions of this work must consider alternatives for illustrating examples of abusive behavior, in order to avoid creating barriers for children, while still achieving the objective of raising awareness about such behaviors.

The SG proposed is aimed at children with good English reading and listening levels. However, since there is a significant number of French speakers in Canada, a future game enhancement should include language customization. Finally, developing serious games in immersive Virtual Reality (VR) environments combined with other learning strategies will enrich the immersive experience of learning about child abuse.

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Appendix

Appendix A: Instrument to determine the level of knowledge by type of abuse.

Personal Information

Name _____
 Age

Child abuse

Section 1 - Answer the following questions

1 Do you know what abuse means? Yes No I do not know

If "yes" is selected, continue with section 2; otherwise, the survey ends.

Section 2

2 Do you know the meaning of emotional abuse? Yes No I do not know

2.1 Could you give us two examples of emotional abuse?

3 Do you know the meaning of neglect? Yes No I do not know

3.1 Could you give us two examples of neglect?

3 Do you know the meaning of Sexual abuse? Yes No I do not know

3.1 Could you give us two examples of Sexual abuse?

3 Do you know the meaning of Physical abuse? Yes No I do not know

3.1 Could you give us two examples of Physical abuse?

Section 3

Match the cases with their corresponding definition.

Column 1 - Cases of abuse

- Threatening to harm a child.
- Burning a child
- Touching the children private's parts
- Not providing enough health care or medicine
- Beating a child
- Not giving a child proper food
- Telling children that they are not important or humiliating them.
- Showing to children pictures of naked person

Column 2 - Definition

- Sexual abuse
- Emotional Abuse
- Neglect
- Physical Abuse

Section 4- Not fill up. Section reserved by the teacher.

Score	Type of abuse
_____	Sexual abuse
_____	Emotional Abuse
_____	Neglect
_____	Physical Abuse

Appendix B: Instrument of measurement to evaluate the serious part.

Form 1

Name: _____

ZeroAbuse is a serious game to prevent child abuse. Its objectives are to teach about child abuse and recognize each type of abuse, empower children to disclose abuse situations and ask for help.

We appreciate your collaboration in playing and evaluating the game due to your feedback is so important to improve how we cover the topics base on your experience.

In order not to miss any observation, we would like you to give us your opinion on the level.

Nivel 1: Child abuse

Comments

Nivel 2 – Neglect

Comments

Nivel 3 – Physical abuse

Comments

Nivel 4 – Emotional abuse

Comments

Nivel 5 – Sexual abuse

Comments

Form 2

Name: _____

Evaluation the ZeroAbuse in general

NARRATIVE CONTENT

The story is engaging.

Strongly disagree 1 2 3 4 5 6 7 8 9 10 strongly agree

Comments _____

The story supports the learning objectives.

Strongly disagree 1 2 3 4 5 6 7 8 9 10 Strongly agree

Comments _____

The lessons are easy to understand.

Strongly disagree 1 2 3 4 5 6 7 8 9 10 strongly agree

Comments _____

The lessons are well written.

Strongly disagree 1 2 3 4 5 6 7 8 9 10 strongly agree

Comments _____

The information is useful.

Strongly 1 2 3 4 5 6 7 8 9 10 strongly
disagree agree

Comments _____

STRUCTURE AND PLAYABILITY

The mini-activities support the learning objectives.

Strongly 1 2 3 4 5 6 7 8 9 10 strongly
disagree agree

Comments _____

Does the player know what they need to do at all times?

Strongly 1 2 3 4 5 6 7 8 9 10 strongly
disagree agree

Comments _____

Appendix C: Instrument of measurement to evaluate the effectiveness and attractiveness of ZeroAbuse.

Form 3.

PERSONAL INFORMATION

Name _____

Age

Are you a boy or a Girl?

Boy

Girl

CHILD ABUSE

1 Do you know what child abuse means? Yes No I do not know

2 Do you know the meaning of emotional abuse? Yes No I do not know

2.1 Could you give us two examples of emotional abuse?

3 Do you know the meaning of neglect? Yes No I do not know

3.1 Could you give us two examples of neglect?

4 Do you think a person who hurts a child is always a stranger? Yes No I do not know

5 Can children hurt other children? Yes No I do not know

6 Can a member of a family hurt a child? Yes No I do not know

7 Can you tell someone about a situation that makes you feel scared or embarrassed? Yes No I do not know

8 Do you think being left hungry frequently is a form of maltreatment? Yes No I do not know

9 Do you think living with a family that fights a lot is a form of maltreatment? Yes No I do not know

10 Are you allowed to say No to adults when they ask you to do something wrong? Yes No I do not know

11 If any relatives or friend hurts you, would you tell someone? Yes No I do not know

12 Who can you ask for help if you have a problem? Mention three options.

13 Can children call 911 to ask for help? Yes No I do not know

14 Do you think that you can help someone if they are being maltreated? Yes No I do not know

15 Are you allowed to report a case of child maltreatment? Yes No I do not know

Form 4.

PERSONAL INFORMATION

Name _____

Games

Answer each question by selecting the face that matches your answer the best

Do you think the game ZeroAbuse was?

Easy to use      Difficult to use

Fun      Boring

A good way to play the game      A silly way to play the game

Easy to understand      Hard to understand

Do you like the game? Yes No

Do you recommend this game to other friends? Yes No

What would you like to add to the game?

What did you not like in the game?

CHILD ABUSE

1 Do you know what child abuse means? Yes No I do not know

2 Do you know the meaning of emotional abuse? Yes No I do not know

2.1 Could you give us two examples of emotional abuse?

3 Do you know the meaning of neglect? Yes No I do not know

3.1 Could you give us two examples of neglect?

4 Do you think a person who hurts a child is always a stranger? Yes No I do not know

5 Can children hurt other children? Yes No I do not know

6 Can a member of a family hurt a child? Yes No I do not know

7 Can you tell someone about a situation that makes you feel scared or embarrassed? Yes No I do not know

8 Do you think being left hungry frequently is a form of maltreatment? Yes No I do not know

9 Do you think living with a family that fights a lot is a form of maltreatment? Yes No I do not know

10 Are you allowed to say No to adults when they ask you to do something wrong? Yes No I do not know

11 If any relatives or friend hurts you, would you tell someone? Yes No I do not know

12 Who can you ask for help if you have a problem?, Mention three options.

13 Can children call 911 to ask for help? Yes No I do not know

14 Do you think that you can help someone if they are being maltreated? Yes No I do not know

15 Are you allowed to report a case of child maltreatment? Yes No I do not know