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AN INNOVATIVE TRANSMEDIA-BASED GAME DEVELOPMENT METHOD FOR INCLUSIVE EDUCATION

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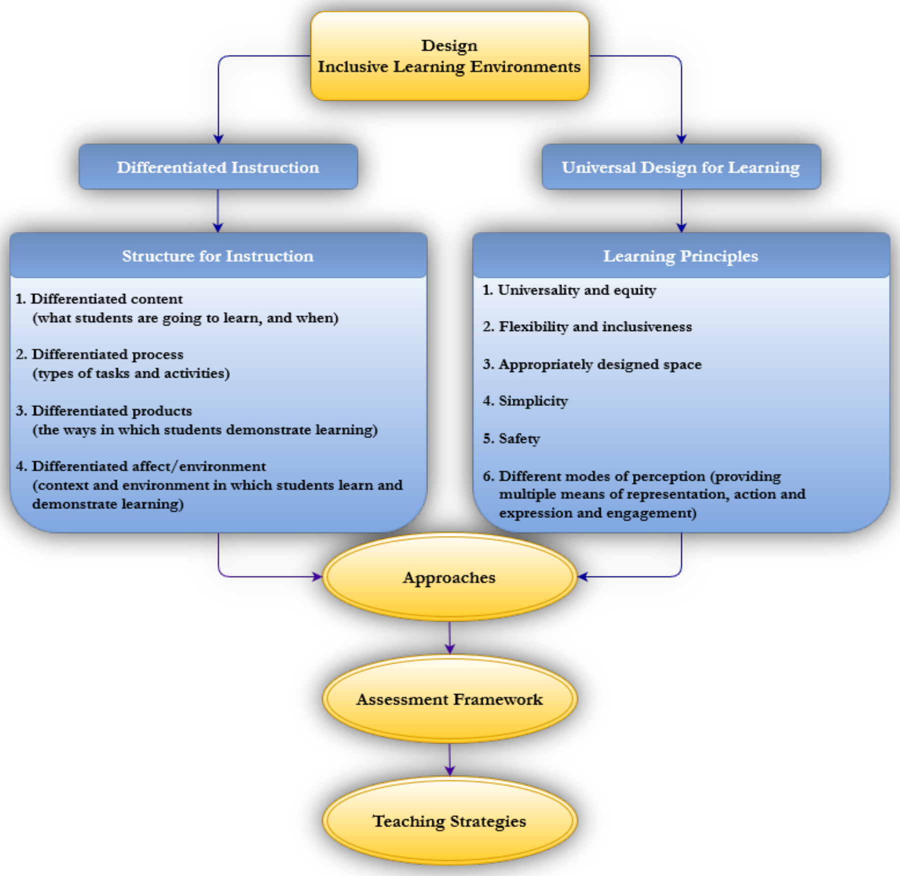
Abstract: *Education is the cornerstone for a society without discrimination as it promotes full personality development and enhances respect for human rights and fundamental freedoms. As a result of the "Education for all" policy, more children with Special Educational Needs and/or Disabilities (SEND) are included in neighbourhood schools regardless of their cognitive, physical or emotional condition. Inclusive education (IE) focuses on learning motivation and styles, different students' learning pace, learning objectives, methods, personalized strategies, material, and content. The degree of independent living of both children with or without SEND is one of the main concerns of educators, parents, and therapists. Children with SEND often struggle to achieve independence because of their limitations in adaptive behaviour. Considering valid epistemological backgrounds, pedagogical frameworks and a range of intervention strategies focusing on those skills, the paper presents an innovate transmedia-based game development method for inclusive education, combining traditional games, art-based production, and game development methodologies with cutting-edge technologies involving 360° videos, virtual, and augmented reality.*

Keywords: *augmented reality; special educational needs and/or disabilities; transmedia learning; virtual reality; 360° interactive videos*

Introduction

Equality and non-discrimination are fundamental principles of the international institutional framework for human rights (United Nations, 1948). A key prerequisite for a society without discrimination is education, which is considered both basic freedom and human right. The *"Education for all"* initiative includes all children, regardless of their physical, intellectual, social, emotional, linguistic or other conditions (UNESCO, 1994). For effective inclusion, certain conditions need to be met, especially by providing robust programs for teachers' preparation (Hehir, Grindal, Freeman, Lamoreau, Borquaye, & Burke, 2016). The main objectives of these programs are to promote positive attitudes towards IE and vocational training regarding inclusive pedagogical approaches and design, development, implementation, and evaluation of educational projects and materials. One of the most widely used design models for educational projects and material is based on a framework of seven axes, known as 5W2H framework: who (subject), what (content), why (reasons), when (time), where (place), how (pedagogical approaches) and how much (cost) of learning (Sloan, 2010). The 5W2H framework can be described as a methodology that considers students' specific characteristics and learning content, answering questions about why the concrete content was chosen, when and where to teach, how and how much it will cost (in terms of human resources, time and funding). An inclusive learning environment welcomes all students (*who*). Curriculum strategies and educational materials (*what*) are designed with all students in mind. Students' diversity also requires inclusive pedagogical approaches rather than "one-size-fits-all" method (*how*). In inclusive environments, pedagogical approaches that estimate diversity are implemented through differentiated instruction (DI) (Tomlinson et al., 2003) and Universal Design for Learning (UDL) (Figure 1) (CAST, 2018; Ontario Ministry of Education, 2013).

Figure 1: Design of Inclusive Learning Environments



Source: Adapted from Ontario Ministry of Education (2013, p. 12)

DI is a widespread pedagogical approach that provides principles for adequate flexibility in designing content, process, product, and learning environment, so that teaching correspond to students' level of readiness, interests, and learning profile. UDL assumes that all students are unique and differ significantly in how they are involved or motivated to learn, perceive and understand information, navigate a learning environment, and express what they know. Therefore, there are not only one optimal means of presentation, expression, engagement, and assessment for all students. Employing a variety of media and platforms in education is part of transmedia learning (TL) which refers to the seamless flow of content on digital and non-digital platforms, such as games, and students' interaction with narration (Alper & Herr-Stephenson, 2013; Fleming, 2013;

Pence, 2011). Games due to their particular elements are recognized as one of the oldest forms of human interaction that influence cognitive development and learning (Plass, Homer, & Kinzer, 2015; Salen & Zimmerman, 2004). In a digital world, games also become digital. In this context, the playful learning process takes place inside and outside the school and every circumstance is a stimulus and motivation for ubiquitous learning using all the available material and devices (*when* and *where*: anytime, anywhere). Virtual reality (VR) and augmented reality (AR) technologies used to mobile game development reshape the learning experience. In terms of pedagogy that underpins VR environments, three features are considered unique: representational fidelity, learner interaction and avatar that constitutes learner's identity construction. These features provide spatial knowledge, experiential learning, engagement, contextual learning and collaborative learning (Dalgarno & Lee, 2010; Fowler, 2015). AR is a variation of VR that allows users to see the real world at the same time with virtual objects which are associated with real sites and images in the existing environment (Trondsen, 2019). The learning experiences offered by AR are achieved through the smooth interaction between real and virtual environments. AR promotes the academic and functional skills of individuals with SEND and improves their participation in society (Baragash, Al-Samarraie, Alzahrani, & Alfarraj, 2020). AR is a particularly advantageous choice for diverse learning environments as it combines and incorporates many of the DI and UDL principles (Kaimara, Deliyannis, Oikonomou, & Miliotis, 2020; Kaimara, Oikonomou, & Deliyannis, 2020; Mcmahon, 2014; Quintero, Baldiris, Rubira, Cerón, & Velez, 2019; Wehmeyer, 2006). VR and AR applications further motivation, enjoyment and collaboration between students and teachers and can offer multiple benefits by enhancing effective teaching through participatory learning experiences (Kaimara, Oikonomou et al., 2021).

The field of Independent Living Skills (ILS) constitutes essential educational content (*what*) for preschoolers and very young elementary school students, regardless of their cognitive profile. ILS have been identified as "life skills", as they are necessary for a dignified life (e.g., well-groomed appearance) or even crucial for survival (e.g., crossing a street) (*why*). However, students with developmental disabilities present significant limitations in intellectual functioning and adaptive behaviour, while facing difficulties in practising these skills (American Psychiatric Association, 2013). Limitations in adaptive behaviour affect both daily living and the ability to respond to life changes and environmental demands.

Given the above, the purpose of this paper is to present an innovate transmedia-based game development method for inclusive education through a mixed film and game production process, that showcases the importance of art-based production methodologies and aesthetics for the development of innovative game content, involving traditional games, 360° videos, VR and AR, taking into account inclusive pedagogical approaches and frameworks. Recognizing that transmedia content production leads to a complex development process, the design team proposes a simplified step-by-step model. To that end, we first introduce the most prevalent intervention strategies for ILS training. Then, we describe the design and development stages of the transmedia project "Waking-Up In the Morning" (WUIM), which is a low-cost content development method (*how much*) that can serve as the know-how for educators to easily develop their own game scenarios with minimal assistance from ICT colleagues.

Interventions for Independent Living Skills Training

Living independently and participating in the community, refers to individuals' ability and skills to care for their own needs without or with minimal support and is inherently linked to inclusive education (United Nations, 2017). However, children with SEND often struggle to achieve independence because of their limitations in adaptive behaviours. The greater the independence of children in academic, social, and daily living skills, the more effective the transition into work-related environments and successful inclusion in society (Shepley, Spriggs, Samudre, & Elliot, 2018). The degree of independent living of both children with SEND and their typically developing peers is one of the main concerns of teachers, parents and therapists; therefore essential educational content is needed (Kaimara, Miliotis et al., 2019; Kaimara, Oikonomou et al., 2021). Several studies have been conducted on the optimal training process, focusing on the acquisition and generalization of these functional skills, while various techniques have been proposed. The instructional approaches commonly used for ILS are:

In-vivo instruction. Practising in an authentic environment ensures natural fidelity and forwards the acquisition, maintenance, and generalization of functional skills, due to the inclusion of natural stimuli and places, such as house rooms, classrooms, courtyards, community buildings, roads, and traffic lights (Ramdoss et al., 2012). For example, planting/watering flowers in the real pot, do the laundry using clothes in a real laundry room with a real washing-machine. The greatest argument for ILS acquisition via in-vivo instruction is based on experiential learning (Kolb & Kolb, 2009). "Naturalistic" approaches may present obstacles arising from the lack or dysfunction in the theory of mind (ToM), such as difficulty in pretending or identification with the specific activity in a particular authentic place, due to the differences (e.g., between their real house-place and public space) (Kuo, Chang, Lyu, & Heh, 2013).

Play-based interventions. The value of play in the physical, cognitive, social, and academic development of children has been explored by pioneers, researchers, pedagogues, and psychologists, such as Piaget, Vygotsky, and Dewey (Charlop, Lang, & Rispoli, 2018b; Dewey, 1922; Plass et al., 2015; Verenikina, 2008). Toy, play and game are terms that meet in the English language but have different meanings. "Toy" refers to the object while "play" refers to an activity as a spontaneous, rule-free play. When play is highly structured, goal-oriented, and rule-bounded, makes up a game (Caillois, 2001). During play, children gain multiple learning experiences by manipulating objects and creating meaningful interactions between people and contexts. Playing experience offers learning opportunities and developmental benefits to an inclusive kindergarten student, by teaching life skills in a simulated area through collaborative play (e.g., pretending to be a cook, or imagining a toy as a different object) (Barton & Wolery, 2008; Charlop et al., 2018b). This kind of play requires individuals' ability to transform objects, toys and actions symbolically, includes role-play, script and creativeness and is supported by interactive social dialogue and negotiation. Role-play as a form of perspective-taking, is directly related to pretence and development of mental representations (i.e., ToM).

Picture-based systems. Visual supports, such as photos, flashcards, pictures, and visual activity schedules with or without texts, are prompts for communication, prediction in performing daily routines, acquisition of new skills, and aid for teaching students with SEND and especially those with autism spectrum disorder (ASD) (Mechling, 2008; van Laarhoven, Kraus, Karpman, Nizzi,

& Valentino, 2010). A familiar visual support system is the "Picture Exchange Communication System" (PECS) (Bondy & Frost, 1994). Students are skilled through symbol exchange. Similarly, visual activity schedules are pictures, images, symbols, and text prompts that are arranged in a sequence for a specific task which help routine, predictability, and consistency to a person's day. Its main advantage is practising communication skills without requiring eye contact or training with other people around.

Social Stories™ (SS), are brief narratives that describe desired social behaviours in words and/or images to explain specific occurrences, social interactions, concepts, or skills (Gray & Garand, 1993). SS provide individuals with missing information about their social interaction. This lack of information is due to their inadequacy in ToM skills, their weakness of central coherence[1] and detail-focused processing, their difficulties in social cognition and pragmatics, such as language-specific characteristics (e.g., echolalia, stereotypic questioning, and communication skills) (Booth & Happé, 2010; Gray & Garand, 1993). Having a weak central coherence, individuals pay attention and focus on irrelevant details, failing to understand the meaning of the "whole." It is essential for educators, therapists, and parents to include 5W questions during teaching social behaviour skills (i.e., "who", "what", "why", "when", "where"). SS are frequently practised in house, resource rooms, and outdoor areas, often in combination with other interventions and tactics, like imitation, PECS, role-playing, video-modelling/prompting, and positive reinforcement.

Video-based instruction (VBI), is a kind of multimodal learning environment that combines verbal and non-verbal modes like dynamic graphics (Charlop, Lang, & Rispoli, 2018a; Park, Bouck, & Duenas, 2019; van Laarhoven et al., 2010). There are two basic forms of VBI: video-modelling and video prompting. The first form is based on the complete presentation of the targeted skill and the second on a step-by-step process. When models are used, whether self-modelling or other same-age children and/or adults, third-person perspective is exploited; when there are no models, we refer to the first-person perspective. Compared to in-vivo instruction, VBI provides students with the opportunity to monitor the behaviour/skill as often as needed (immediate feedback, repetition) and cost-efficiency (approximately one-third of the time with one-half the cost when compared to in vivo procedures) (Corbett & Abdullah, 2005). Video prompting has the benefit of presenting content in smaller steps, which helps students with SEND to focus on each step rather than on the whole task or activity, while video-modelling can reduce the negative effects of stimulus overselectivity[2] that is widespread across many disabilities, especially of students with ASD.

Computer-based intervention (CBI), guides students through visual and auditory stimuli associated with real-life targeted behaviours/skills (Ramdoss et al., 2012). In contrast to VBI, CBI allows students to interact with the program via external hardware devices and supports their self-regulation, pace, and control by providing the desired level of difficulty and time needed. Modern computers can incorporate all of the aforementioned forms of intervention, thanks to ever-evolving technologies (e.g., virtual and augmented reality, mixed reality, holograms, and robotics) and advanced devices

[1] Coherence refers to the tendency for integrating information in context for higher-level meaning, very similar to the principles of gestalt psychology.
[2] Stimulus overselectivity occurs when one element of the behaviour of a complex-stimulus controls the expense of other equal elements of that stimulus.

with high-sensitivity (e.g., touchscreens, microphones, wearable devices, sensors, and eye tracking)(Deliyannis & Kaimara, 2019; Kaimara & Deliyannis, 2019). Hardware and software combination increases the interactivity which is the basic element of learning effectiveness in computer-enhanced learning environments (Sims, 2000). This combination allows people with disabilities to engage with learning experiences by overcoming their physical and cognitive limitations. Thus, the boundaries determined by the medical model of disability can be reduced (Oliver, 2004). A variant of CBI is the *Computer-based video instruction (CBVI),* which provides simulated instruction within realistic and interactive learning environments, in which students have to practice the desired skills (Goo, Therrien, & Hua, 2016). CBVI allows greater student independence during instructional activities (Ayres & Cihak, 2010).

The main weakness regarding the effectiveness of all these approaches, when are implemented individually, is related to the transferability of taught skills to real-life, given that children with SEND struggle with comprehending symbolic play/thinking and pretence, present low imagination level, resistance to changes to their environment or daily routines, and limited ability to identify with others (Kaimara, Miliotis et al., 2019). This is why a combination of many approaches is usually recommended. Nowadays, academics have turned to research on game-based learning. Although digital games provide educational opportunities and learning experiences due to their dynamics, limited attention has been given to design them according to the needs of children with SEND (Hersh & Leporini, 2018; Tsikinas & Xinogalos, 2019). The case of educational design for children with SEND is challenging because even if they share common features under their diagnosis, they do not present typical cognitive development. Due to individual differences, digital game design and development addressed to all students is a very complicated process; when designing inclusive educational games to meet the needs, preferences, and interests of each student in a diverse classroom, many questions arise about the user experience.

Developing Digital Games in the Context of Transmedia

The growing recognition of digital games as persuasive educational means has led our design team to organise the transmedia project WUIM, which provides educational content for teaching the morning routine (Kaimara, Oikonomou et al., 2021). The transdisciplinary team consists of school psychologists, academics (expertise in informatics, interactive multimedia, educational game and educational psychology), director, photographer, and specialists in video and sound editing. The concept of the overall project was based on research regarding students' gaming experience in an inclusive environment and was designed with two key issues in mind: (i) the final products to function as educational resources in the context of ILS training, both for students with SEND and their typically developing peers and (ii) the gaming experience to become the bridge between children regardless of their cognitive profile, and to promote collaborative learning through peer-mentoring. Participatory design and formative evaluation are essential methods in the testing stage (Ramadan & Widyani, 2013; Steinböck, Luckner, Kayali, Proyer, & Kremsner, 2019). Assessment methodologies in digital games are strongly related to the game development phase including user-based and expert-based evaluation: concept, preproduction phase, prototype, production, localization, alpha-phase, beta-phase, gold, and postproduction (Novak as cited in Bernhaupt, 2010). Depending on the phase of game design and development, quantitative and qualitative methods are conducted by observation, self-reported measures, interviews (structured or semi-structured), usability tests, informal playtesting, cognitive walkthroughs, video coding, questionnaires focusing on gamers' attitudes and experiences, and heuristic evaluation for experts (Almeida et al., 2018; Bernhaupt & Mueller, 2016; Kaimara, Fokides, Oikonomou, Atsikpasi, & Deliyannis, 2019, Kaimara, Fokides, Oikonomou, & Deliyannis, 2021). We conducted both user-based evaluations by children with SEND and expert-based evaluations by specialist therapists, teachers K-6 and K-12 (content experts) and by game experts (design and development experts). Evaluations were based on observations and structured interviews (for children with SEND) via two questionnaires: (i) System Usability Scale (SUS)(Brooke, 1996) and (ii) Serious Games Evaluation Scale (SGES) (Fokides, Atsikpasi, Kaimara, & Deliyannis, 2019). Experts completed the same questionnaires. Their insightful comments were incorporated into the next phase for improving the products.

Elements of Game Design and Gamification Techniques

Digital games and gamification techniques are terms generally used when referring to the learning process through games. Digital games are structured applications that include rules, goals, feedback, challenges, conflict, and competition (e.g., problems or puzzles that players/students are trying to solve, not necessarily related to an opponent), interaction, achievements and narration (Prensky, 2007). Gamification refers to the utilization of game elements to motivate players/students to engage in an activity that they would not otherwise do, as they would not find it attractive (Deterding, Dixon, Khaled, & Nacke, 2011; Plass et al., 2015). Although digital games and gamification are significantly different, their learning dynamics are based on an essential activity in common: play. Fundamental elements of game design are game mechanics, visual aesthetics, narrative, incentives, musical score, learning objectives, content and skills (Plass et al., 2015). Salen and Zimmerman (2004) argued that the real field of game design is the aesthetics of interactive systems. Directly connected to the fundamental elements of games is the gameplay, i.e. the way the game is played. More specifically, the concept of gameplay refers to the set of activities that can be performed by the player/student during the gaming experience. Player's interaction and actions are two basic notions of gameplay that can be approached through the tetrad of Schell (cited in Kosmadoudi, Lim, Ritchie, Louchart, Liu, & Sung, 2013): aesthetics, mechanics, technology and story.

In this context, we have created three different applications either as entire games (cf. traditional games like flashcards and wooden block puzzle called "WUIM-Puzzle" and VR version called "WUIM-VR") or simply using gamification techniques (cf. AR version called "WUIM-AR") that share the same content. WUIM-Puzzle and WUIM-VR can be played independently, while WUIM-AR is combined with WUIM-Puzzle since wooden blocks operate as the AR trigger.

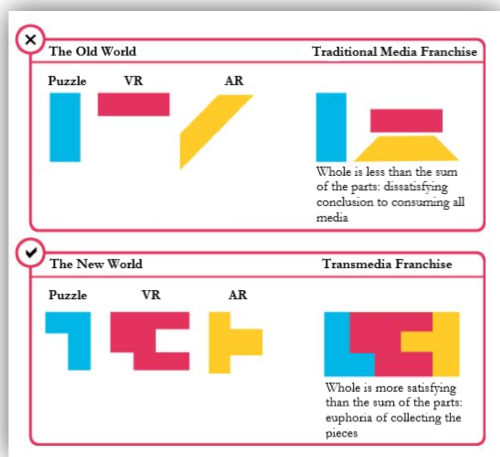
Game content design under transmedia

The WUIM project is based on TL that incorporates the basic principles of learning theories of constructivism and connectivism (Alper & Herr-Stephenson, 2013). Students construct their knowledge from a variety of different sources, across different media platforms, through meaningful, challenging, technology-enhanced experiences, no matter their starting point. This dynamic ecosystem of TL allows the synergy across different learning models and pedagogies

(Fleming, 2013). It is therefore understood that TL not only coincides with the UDL framework but also with DI. WUIM project integrates all the prevailing interventions, i.e. *in-vivo instruction, play-based interventions, picture-based systems, SS, VBI, CBI, and CBVI.*

The most characteristic schematic interpretations of transmediality are credited to Pratten (Figure 2) (Pratten, 2011). Pratten sets another dimension in the transmedia storytelling, that of the audience. Hence, transmedia storytelling is about telling a story across multiple media and preferably with audience participation, interaction or collaboration for continuing, expanding or even changing the story (Fiorelli, 2013; Pratten, 2011).

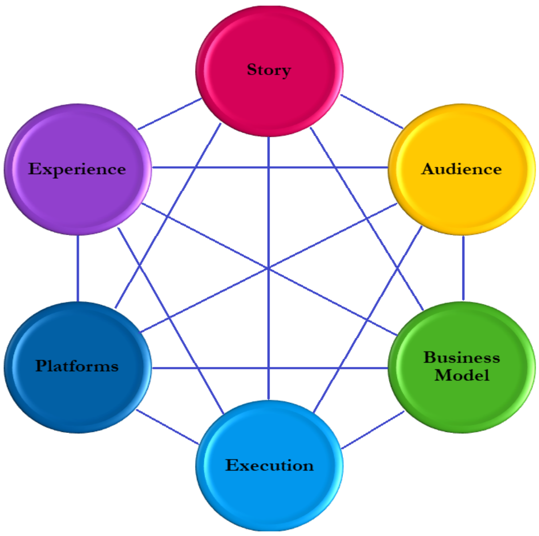
Figure 2: The concept of WUIM Transmedia



Source: Adapted from Pratten (2011, p. 2)

To develop the WUIM project, we followed Pratten's Project Model which is consisted of a loop with six key components (Figure 3).

Figure 3: Pratten's Project Model



Source: Adapted from Pratten (2011, p. 2)

In brief, we defined the *story* (concept, content, genre, characters/avatars/agents, plot), the *audience* (students, age, learning profile, type of technology students use, design engagement, user experience and interfaces), the *experience* (importance of narrative, participation, real-world and gaming), the *platforms* (i.e., media/technology), the *business model* (cost and access) and the *execution*. Execution comprises a five-stage workflow for achieving the transmedia experience: (1) setting objectives to create a particular experience (goals, scope, team), (2) idea development and creating a skeleton (concept, art/multimedia direction, design summary, licensing and copyrights), (3) experience design and documenting (timeline, languages, subtitles, interactivity, gaming, platforms, future stories), (4) distribution of experience to the audience (production, implementation, testing, measurement) and (5) wrap. The advantage of this workflow is that each stage carries over the design experience to the next level (Pratten, 2011).

WUIM story was designed for teaching the morning routine to an audience that consists of pre-schoolers and first-grade students with and without SEND (mental age), focusing on self-directed teaching, collaborative learning through peer-mentoring and gaming experience by employing a human avatar and a supporting actor which provide image fidelity to ensure natural representation. Additionally, a human pedagogical agent as a tutorial is presented. Content development followed the filmmaking production phases using 360^{o} camera, i.e., pre-production, production and post-production, paying special attention to sound and image aesthetics (Panagopoulos, 2019). In addition to creating traditional technology materials and platforms such as flashcards, wooden boards and blocks, cutting-edge technology platforms have been also developed, i.e., VR and AR. Regarding the business model, the main concern of the design team was the low cost and ease-of-use applications, utilizing everyday technology and devices such as 360^{o} cameras, smartphones, smartphone headsets, smartphone Head-Mounted VR Glasses, tablets and controllers (Figure 4).

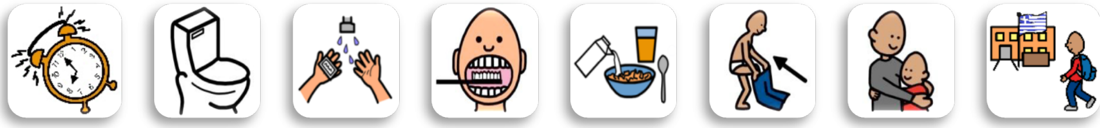
Figure 4: Everyday devices

The first step in creating transmedia content was based on using the same symbols, either printed for traditional games (flashcards and WUIM-Puzzle) and WUIM-AR or digital as buttons for the WUIM-VR. Under the permission of Tobii Dynavox Picture Communication Symbols®, we chose specific symbols[3] from the Boardmaker collection that serve the story flow, focusing on

[3] The symbols were deliberately chosen from Boardmaker collection because they are widely known in the field of special education and students are familiar, so no extra training time is required.

hygiene rules and social norms: alarm clock, toilet, handwashing, breakfast, toothbrushing, dressing up, parent hugs and walking to school (Figure 5).

Figure 5: 8-Steps morning routine with a linear narrative



WUIM game content development

The game is structured in rooms of a typical family house based on escape room game pedagogy. Escape room pedagogy relies on Vygotsky's social-constructivist approach that engages students in real-life activities enhancing role-playing, creativity, decision-making, communication and critical thinking (Fotaris & Mastoras, 2019). Each room is a scenario unit, i.e., a complete story, an element that is necessary to characterize an application game. WUIM's rooms (bedroom, bathroom, kitchen) cover some of the thematic units, objectives (social skills, personal care and hygiene rules) and indicative activities according to ADLs, following the flow of pictured-based systems. In the linear narrative, the main character (avatar), Vicky, once she is out of bed, follows a series of events governed by everyday logic: first she goes to the bathroom/toilet and, after washing her hands, heads to the kitchen to have breakfast. When breakfast is over, she gets back to the bathroom, where she brushes her teeth. She then goes to her bedroom, takes off her pyjamas, puts on her clothes and heads to the front door area where she puts on her shoes, picks up her school bag, greets her mom and opens the front door to go to school.

The activities completed within each room are generalised, e.g., "handwashing" is not analyzed into separate handwashing steps. However, due to the flexibility offered by the game development application (flashcards and digital), the possibility of adding content to create mini-game scenarios is also provided. This feature can be activated both by the design team if that needs to be implemented at a later developmental stage or by teachers and parents with simple content changes and adjustments to the main system so that the transmedia principle can be enhanced by content enrichment. An additional feature is that the base system can be used to create a new gamified scenario if the users decide to implement it. Of course, this would require more technological competence and basic programming abilities as a complete content-development process including voiceover and the game logic has to be re-designed. As mentioned, WUIM-VR and WUIM-AR provide a pedagogical agent, who supplies sound assistance (voice-over) when needed, without disturbing the students[4]. Human voice arouses students' interest and leads to an emotional connection with the agent, thus facilitating the educational process which in turn encourages constructive learning (Moreno, Mayer, & Lester, 2000). The goal of all version of games is for students to perceive the correct sequence of the activities performed at home and depicted in the symbols. To this end, students are asked to choose the correct symbol from a series of symbols given mixed, but always in the same mixed order, for WUIM-Puzzle and WUIM-AR (following

[4] Pedagogical agent appears on the screen only to give the initial instructions, help at students' options and reward in AR version. Rewards in the VR version are given orally.

the Picture Arrangement-PA subtest guidelines of WISC-III[5]). Choosing the right route will allow them to leave the house, i.e., escape room scenario. However, making mistakes is a large part of how children learn and in games, failure is approached as an opportunity to learn and take risks, without being punished (Bruner & Watson, 1983; Gee, 2008). As the principle of discovery is a key aspect of games, while players are navigating, it is not uncommon for them to make intentional mistakes out of curiosity to see how the game unfolds from a different perspective. The pedagogical principle of accepting errors is a learning tool that leads students to evaluate their previous course and try to play again. WUIM is based on replayability, an important parameter of educational games, i.e., players' ability to play over and over again, changing their choice each time. Since the concept of error does not lead to punishment (negative reinforcement), students are free from the stress of achievement. Through replayability, students engage in repetitive crises and receive feedback based on a non-linear narrative (Thomas, Schott, & Kambouri, 2004).

Traditional games: Flashcards and WUIM-Puzzle

Flashcards and wooden puzzles are classic symbol-based communication methods for both children with disabilities and preschoolers as they support hand-eye coordination, fine motor skills and cultivate visual perception skills (Selvanathan, 2012). To create the flashcards, symbols were simply printed and laminated (Figure 6). Flashcard game is the plainest version and does not require any special equipment. Besides, flashcards act as a storyboard.

Figure 6: Flashcards

To create the wooden puzzles, shapes were designed with CorelDRAW® software and then were cut with CNC (computer numerical control) wood route by a carpenter. Afterwards, the symbols were printed on a vinyl sticker and stuck to the wooden pieces (Figures 7-9). The wooden puzzles were produced in two difficulty level. The first and easiest level (Figure 10) includes geometric shapes that guide students alongside the symbols (essentially, the game provides built-in gameplay that promotes constructive thinking)(Ke, 2016). The second level contains only square shapes, so students have to place the correct block considering only the symbol (Figure 11). The difficulty two levels were determined based on the principle of equality so that no student is excluded from

[5] PA subtest guidelines was followed regarding both sequencing and cognitive load (6 images) There is no issue of Ethical Principles of Psychologists and Code of Conduct (material is not part of a psychometric tool).

the learning experience. Learning shapes is resulting in a side benefit. Both levels provide for handles (pins) to students with fine motor skill difficulties.

Figure 7: Wooden pieces are cut with CNC

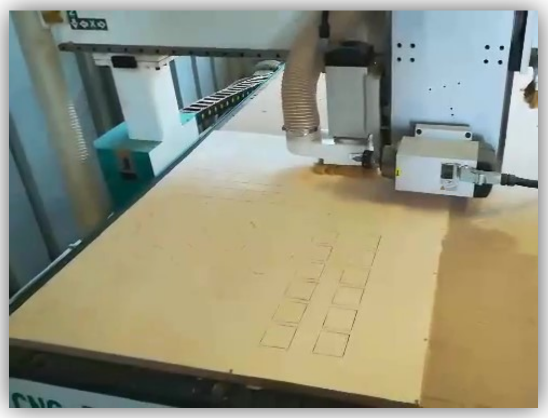


Figure 8: Symbols are printed on a vinyl sticker

Figure 9: Wooden puzzle blocks

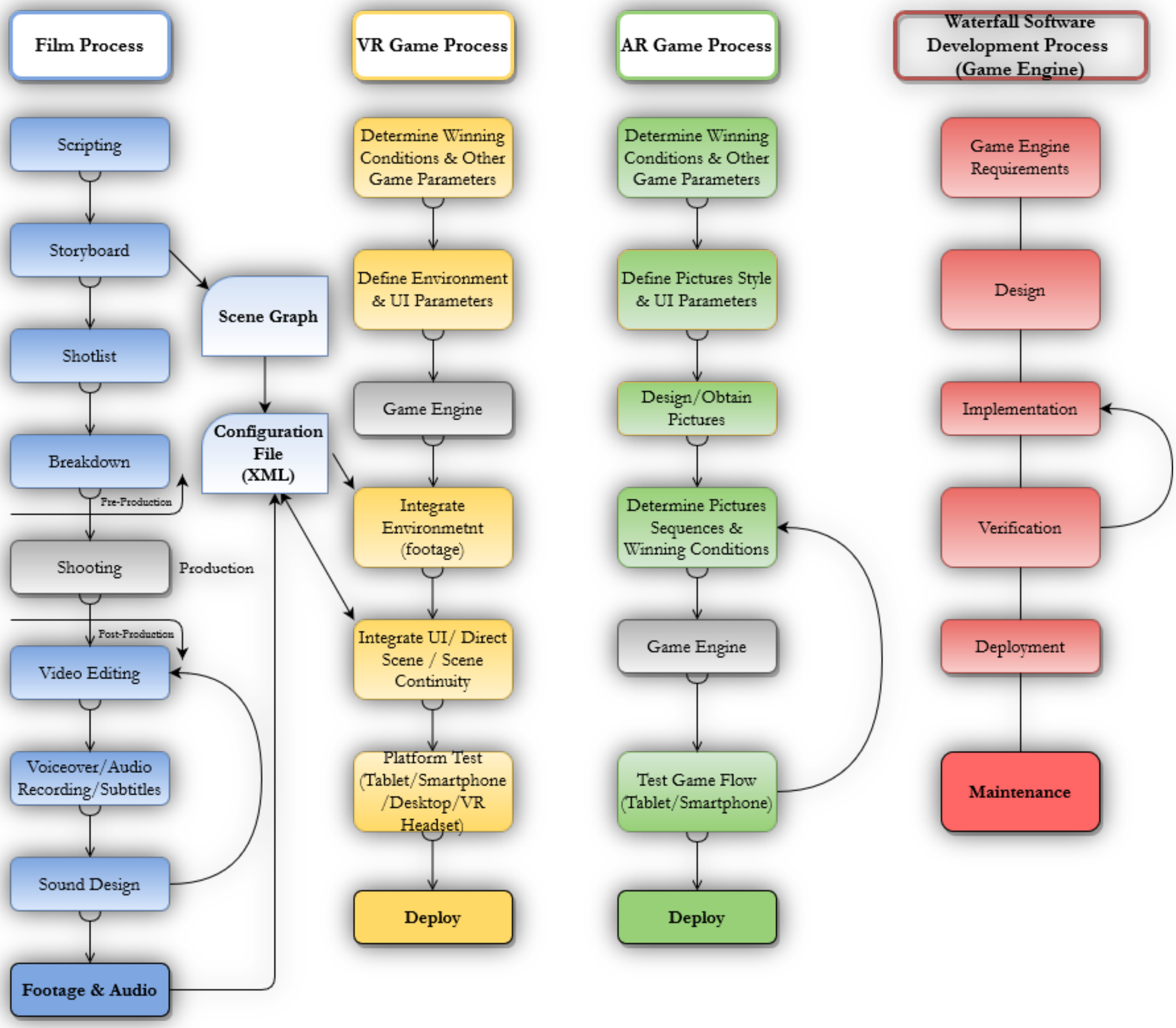
Figure 10: Wooden multi-shape block puzzle

Figure 11: Wooden square block puzzle

Game development with cutting-edge technologies

WUIM VR and AR games could be described as simulations since their content originates from real-life based on 360° interactive videos that enhance presence and immersion. Human-computer interaction was developed by the Unity Game Engine and Vuforia Engine, adopting a third-person perspective. Digital material development followed a parallel and sometimes a diverse course. Combining different technologies in one development process could lead to a complex model that would create more confusion and less ease. Indicatively, film pre-production (scripting/storyboard, etc.) occurs before and during the alpha phase of game development, film production during the alpha phase and film post-production before and during the beta phase of game development. Thus, a simplified model was decided in which the design team was divided into smaller groups, i.e., film production group and game development group that operated concurrently coordinated by the project manager (Figure 12).

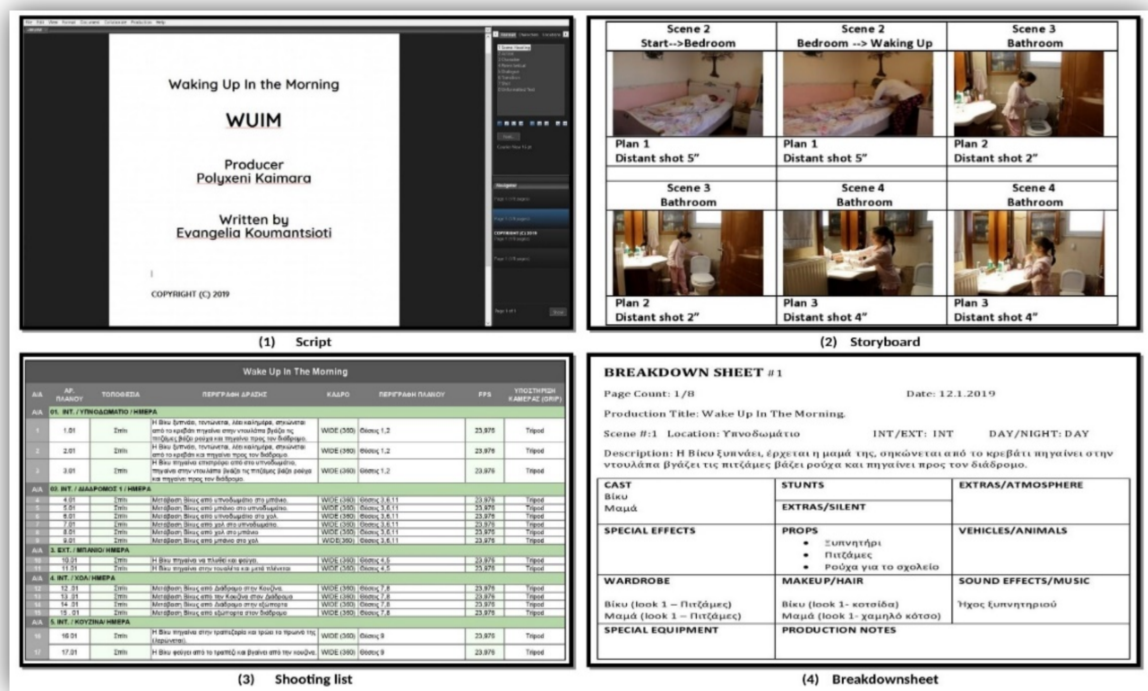
Figure 12: Process Overview Game Development



Art-based production with 360° videos (film process)

As mentioned, filmmaking production involves three phases. Script (developed with the program *Fade In Professional Screenwriting Software*©), storyboard (developed by photo shooting to enhance natural representation and actors' rehearsal), shot list and breakdown sheet were prepared in the pre-production phase (Figure 13).

Figure 13: Pre-production Phase



Film production followed, which in our case focused on shooting 360° video (Figure 14).

Figure 14: Production Phase

Kitchen Scene: The avatar while acting in the kitchen, gets ready to eat breakfast, looks at her hands, wondering if they are clean (360º video).

Finally, in the post-production phase, we proceeded with the audio and video editing, converting 360º videos to standard for the AR version (Figures 15a-15b), shooting and voice recording the human pedagogical agent (Figure 16) and creating subtitles with the program Veed Studio© (Figures 17).

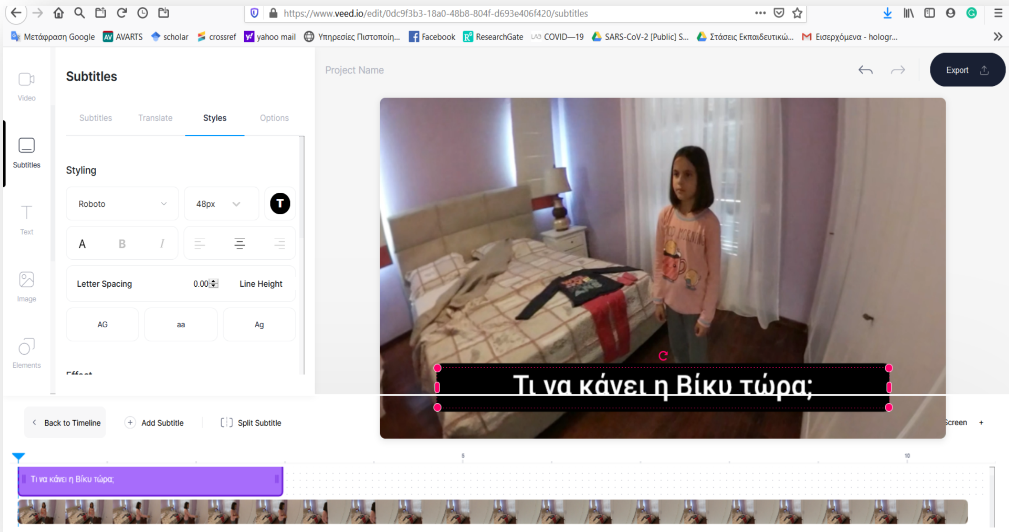
Figure 15a: Post-production Phase: convert 360º video to standard (for AR application development)

Figure 15b: Post-production: after converting

Figure 16: Post-production Phase: shooting the pedagogical agent

Agent welcomes students, guides them (tutorial) and provides instructions for the gameplay, help and verbal reinforcements (e.g., well done, congratulations, etc.) when students find the appropriate picture/puzzle or persuasions to continue the effort if their choice is incorrect.

Figure 17: Post-production Phase: Creating subtitles (black background/white letters – large fonts)



Subtitles are a successful vocabulary learning tool in the context of dual-coding (verbal and nonverbal/auditory-visual encodings) and multimedia theory principles (Kanellopoulou, Kermanidis, & Giannakoulopoulos, 2019; Moreno & Mayer, 2007; Sadoski, 2005) and also valuable resources for hard of hearing students. Subtitles and font size are displayed at the student's choice and depending on a possible type of vision loss (Figures 18-19).

Figure 18: Post-production Phase: subtitling pedagogical agent (black background/white letters – medium fonts)

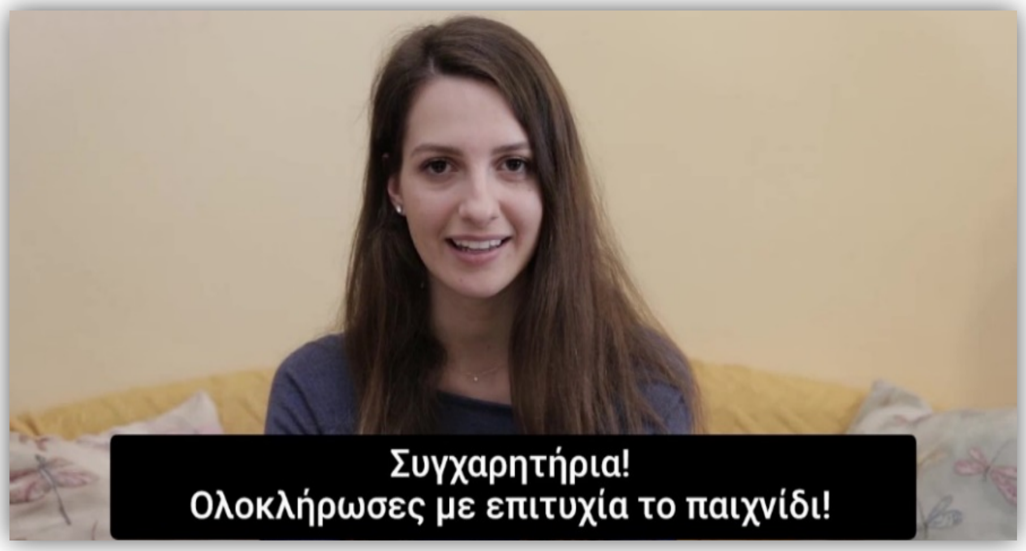
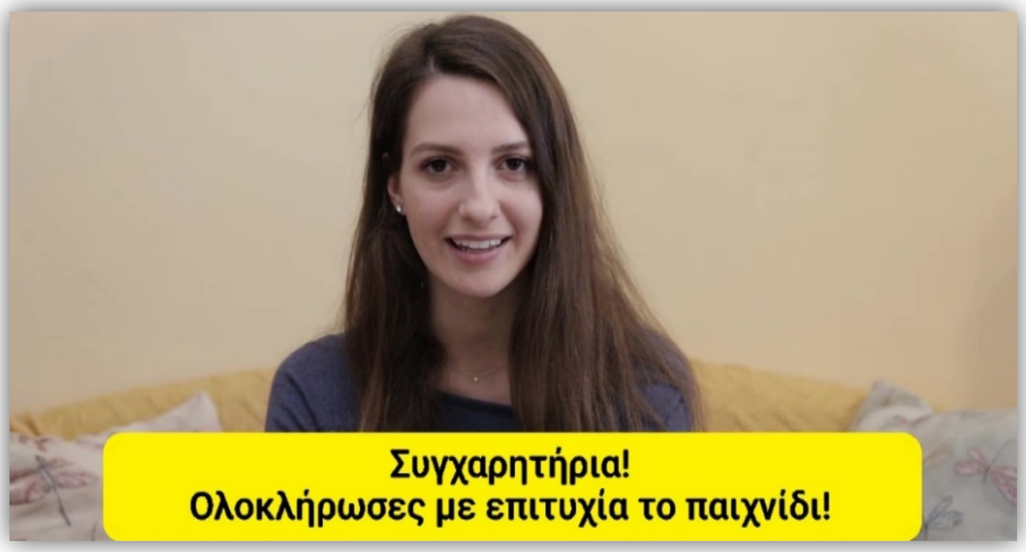


Figure 19: Post-production Phase: subtitling pedagogical agent (yellow background/black letters – medium fonts)



Virtual reality game process

VR gameplay was based on students' freedom to interact with the content. Students are welcome to navigate, discover and make mistakes. The only condition for successful game completion is to meet the rules of transmission from activity to activity, e.g., "you cannot eat if you have not washed your hands". As shown in the "kitchen" room (Figure 20), to open the front door to go to school, Vicky must have completed the micro-routines, i.e., toilet ⇨ clean hands, breakfast ⇨ brushing teeth and not wearing pyjamas. The VR game engine dynamically loads an XML-encoded model (Figure 21) of the learning scenario (Figure 20) into the Unity application as scenes and a state machine (Figure 22 is an example of what is created), alongside the choices and media available, and then presents it in a VR environment. Environments in the scenario are converted into Unity scenes, each one containing a graphical icon (symbol) links to other scenes that are activated when looked at for a specific amount of time or with a controller. Once activated, these triggers will display a video transition to a new scene. Each transition contains activation rules so that for example, you cannot leave the bathroom without washing your hands. Finally, the game keeps track of global states in the state machine, such as "teeth washed", "is dressed", "has eaten breakfast", used in the transition rules. This is also the way the winning condition for the game is specified.

Figure 20: Virtual Reality Gameplay

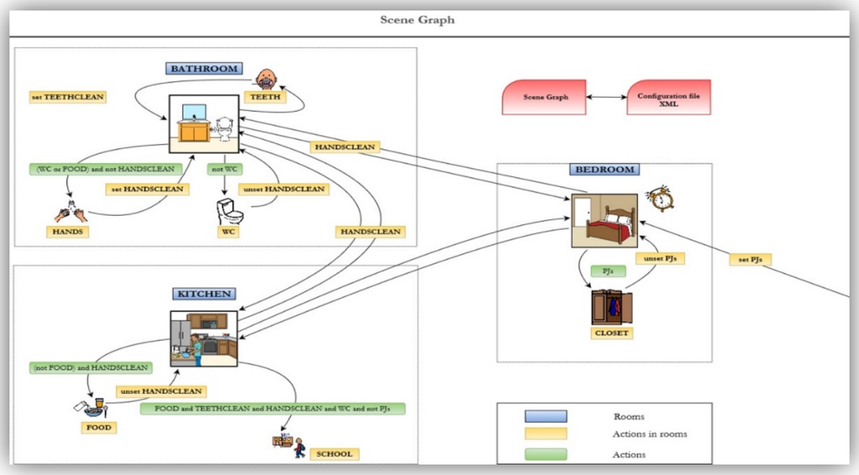


Figure 21: Sample game engine scenario configuration file

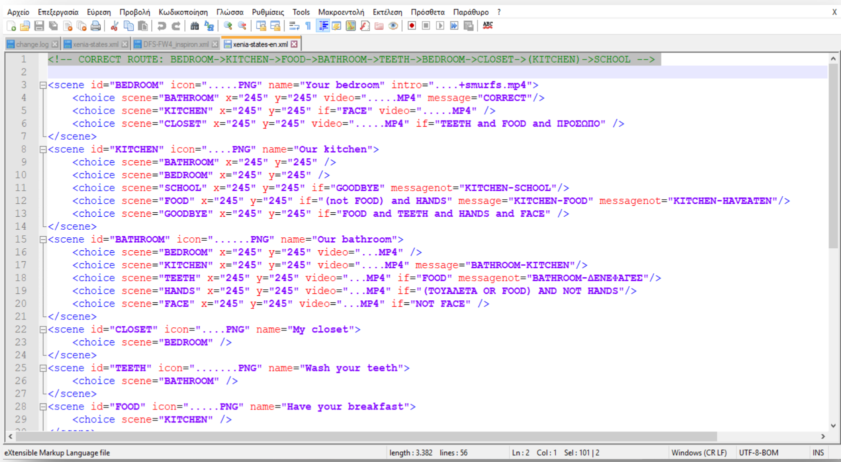


Figure 22: Unity interface after loading scenario configuration file

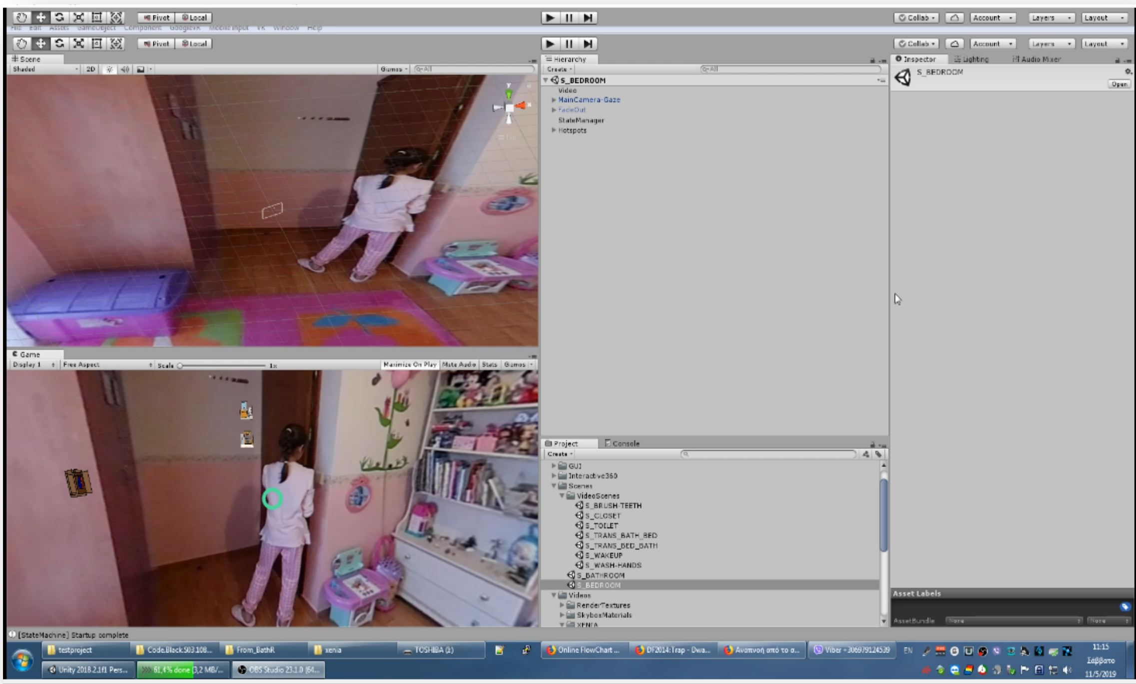


Figure 23: Stereoscopic 360° computer-generated imagery (CGI) - Head-Mounted VR Glasses screenshot

To achieve collaborative learning in a VR environment that a priori isolates students while wearing smartphone Head-Mounted VR Glasses (Figure 23), classmates monitor their progress in a tablet and assist if needed.

Augmented reality game process

WUIM-AR gameplay is determined by WUIM-Puzzle. Once students insert wooden blocks into the board they can scan them with smartphones/tablets. A unique sequence of wooden blocks is the trigger for the AR application operation. When a combination is correct, i.e. taking off pyjamas after toothbrushing, the appropriate video is displayed (overlay). AR flowchart represents gameplay, interfaces and students' potential options (Figures 24). Applications were developed with Vuforia Engine and Unity Engine. Vuforia Engine Developer Portal (Figures 25) accepts images, which it processes by converting them into IDs/triggers and then creates a database with the elements to be used in the application both game and tutorial.

Figure 24: WUIM-AR Flowchart

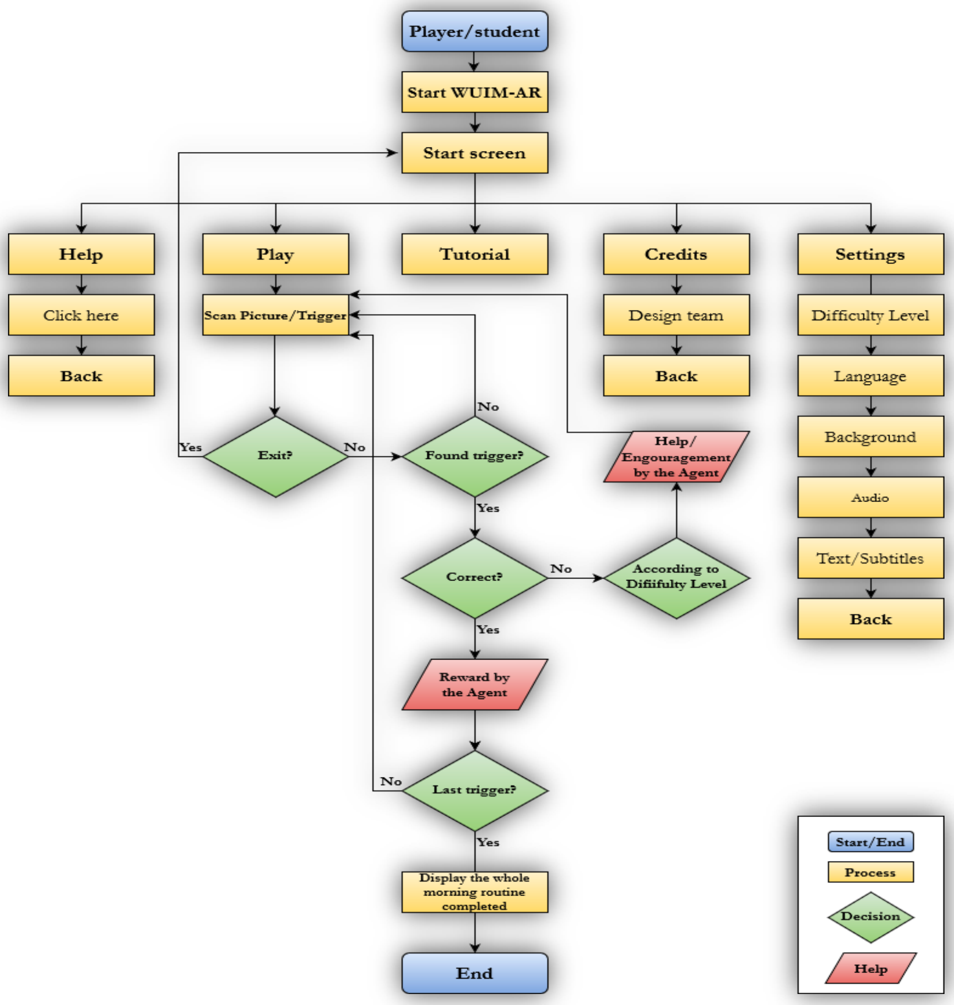
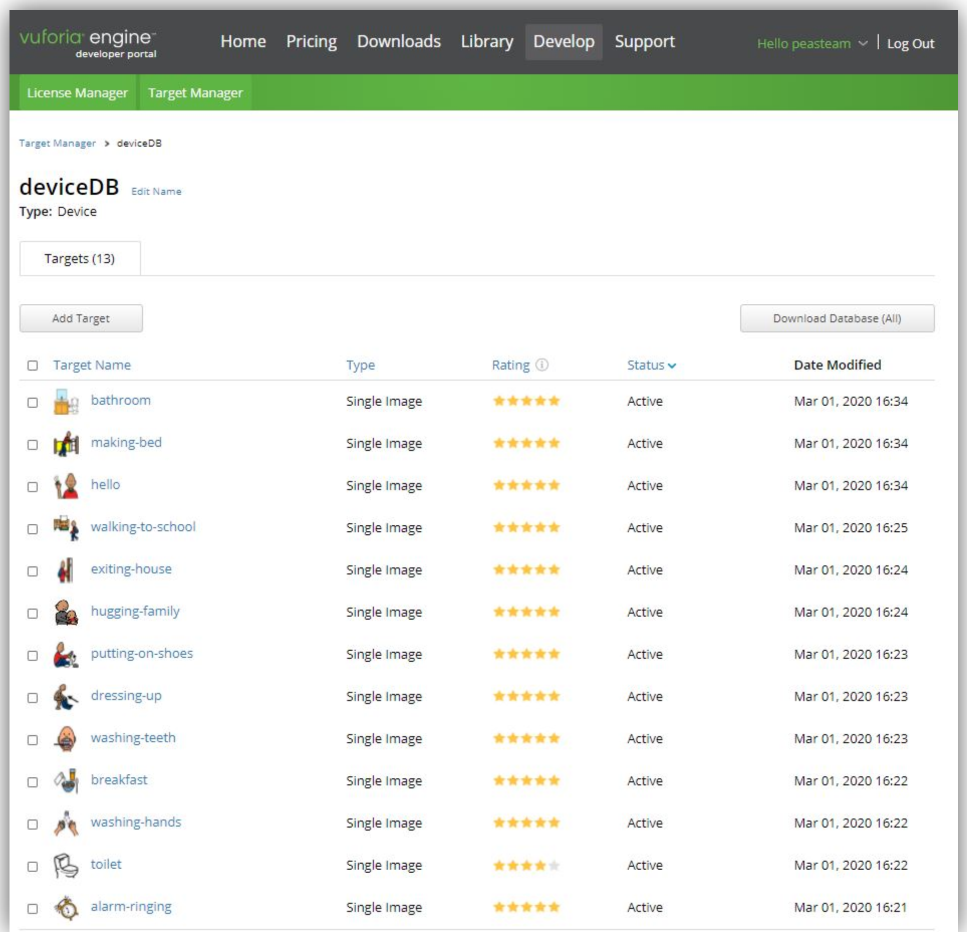


Figure 25: Vuforia Engine Developer Portal



From the beginning, a list is created like a chain of images where each image recognizes which comes before it (Figure 26).

Figure 26: Targetlist

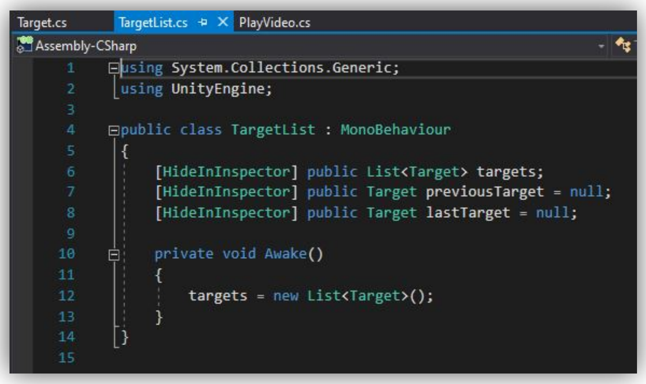
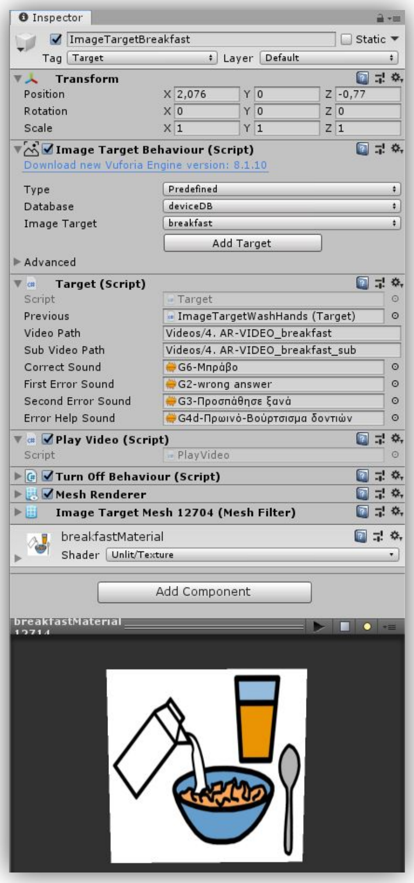
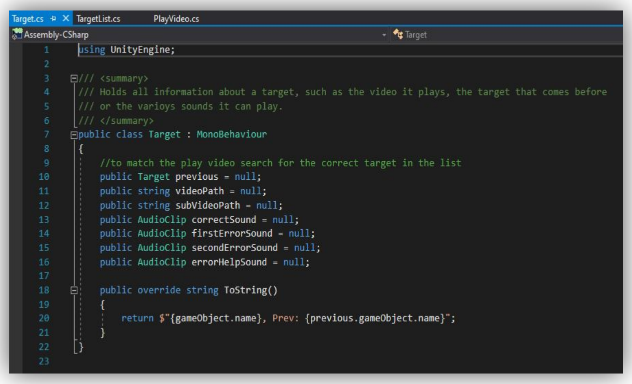


Figure 27: Unity inspector



Information is given for each image such as the video to be played when the image is detected (Figure 27). Also, videos or sounds that should appear when the student has difficulty finding the next image to be scanned as well as the image that must have been previously detected (Figure 28), i.e., the unique combination, e.g., I eat after washing my hands.

Figure 28: Target



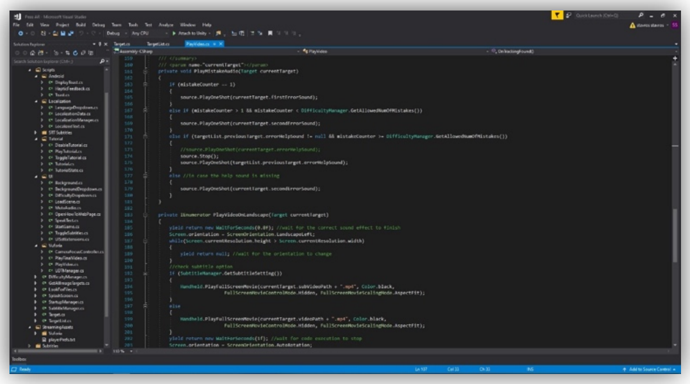

```
using UnityEngine;

/// <summary>
/// Holds all information about a target, such as the video it plays, the target that comes before
/// or the varioys sounds it can play.
/// </summary>
public class Target : MonoBehaviour
{
    //to match the play video search for the correct target in the list
    public Target previous = null;
    public string videoPath = null;
    public string subVideoPath = null;
    public AudioClip correctSound = null;
    public AudioClip firstErrorSound = null;
    public AudioClip secondErrorSound = null;
    public AudioClip errorHelpSound = null;

    public override string ToString()
    {
        return $"{gameObject.name}, Prev: {previous.gameObject.name}";
    }
}
```

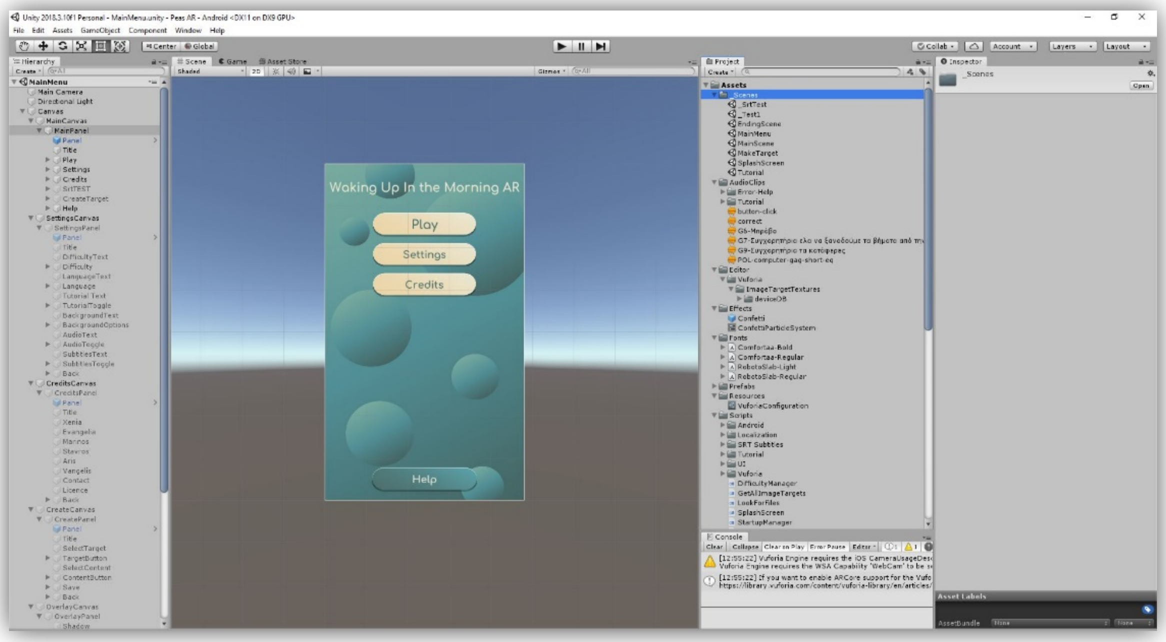
During the game, the current image of the chain is stored in the memory. When an image is recognized, the game checks if the previous image of the recognized one is the same as the last scanned. If yes, then the recognized image becomes the last scanned and the corresponding video and sounds are played, if not, a sound (beep) in conjunction with vibration is occurred depending on how many consecutive times the student has made a mistake (Figure 29).

Figure 29: Code Snippets in Visual Studio



Game settings such as level difficulty, subtitles, language and some visuals are stored in a non-application file to remain the same even after the game is closed (Figure 30).

Figure 30: Editor of Main Menu



Implementation and Evaluation

As mentioned, when designing pedagogical material, participatory design and evaluation are important (Kaimara, Oikonomou et al., 2021; Steinböck et al., 2019). User experience is the greatest indicator of applications success. In the testing phase, we conducted both user-based and expert-based evaluations. Thus, WUIM applications were evaluated by 11 children with disabilities themselves (Figures 31-33) with or without collaboration with their therapists (Figure 34), by 7 specialist therapists, and 2 developers (Kaimara, Oikonomou et al., 2021). Children's evaluations were based on observations and structured interviews via: (i) System Usability Scale (SUS)(Brooke, 1996) and (ii) Serious Games Evaluation Scale (SGES) (Fokides et al., 2019). Experts completed the same questionnaires. Their evaluations were about content, technical issues, user state of mind and perceived learning. Children's and experts' remarks were about technical issues. Also, researchers noticed technical issues during their observations. Observations, users' and experts' recommendations were decisive both for user interface, e.g., font size, and tablet stability issues for children with fine motion difficulties. So we enlarged the fonts and procured special tablet cases with handles (Figure 35).

Figure 31: Students playing WUIM-VR

Figure 32-33: Students while scanning with tablets, playing WUIM-AR

Figure 34: User-based evaluation: student while playing with her therapist

Figure 35: Cases with handles

Conclusion

In this paper, we described step by step a complex transmedia content production process and the way that can be re-used to suit particular purposes, effectively, interestingly and constructively. We have incorporated important interventions that are most often used in special education. We choose symbols from Boardmaker Collection according to the "Picture Exchange Communication System" (PECS) theory, because they are widely known in the field of special education, and students are familiar, so no extra training time is required. The choice of these concrete symbols was based on the factors that figure out an effective user experience design: *creditability, desirability, usability, findability, and accessibility* (Kaimara, Oikonomou et al., 2021). We created three game applications based on play-based theories, in all its forms, as a toy, play and game, that support children's learning and cognitive development. The choice of wooden puzzles was based on the Montessori method, as the wedges enhance cognitive functions, such as problem-solving and spatial skills, but also improve fine motor skills (Lillard, 2013). Traditional games (flashcards - puzzles) and the AR application were based on linear storytelling and task analysis, which are keys dimension of special education programs according to the Applied Behavior Analysis (ABA) sequence (Pratt & Steward, 2020). The foundation of the VR application was the theory of discovery learning (Bruner & Watson, 1983). WUIM project is the result of the synergy across different learning frameworks, pedagogies, and technologies (traditional and digital), which underline the importance of transmedia learning dynamic ecosystem (Fleming, 2013). The authors' intention was to showcase to educators and developers the possibilities of transmedia learning in the field of inclusive education, as due to classroom diversity, students can take advantage of all available means to achieve the same cognitive goal. Because transmedia content development is a complex and multifaceted process, we recommended a simplify way to design and develop educational content. Moreover, according to transmediality, we encouraged therapists and parents to extend the basic story and elaborate with their children, using additional symbols and whatever technology they have available and they feel comfortable. Finally, we suggested ways in which each training step becomes more detailed, e.g., toothbrushing can be split into smaller steps, i.e., get toothbrush, put toothpaste, etc (Figures 36). Morning routine could also be extended to inclusive classrooms (Figures 37).

Figure 36: Extended story for toothbrushing

Figure 37: Extended story to inclusive classrooms

All the above are in line with the research of Warren, Wakefield, and Mills (2013, p. 69) who argue that *"a transmedia story is never-ending, and it is continuously reshaped with the help of peer constative feedback*". Thus, it can be perceived as "*a continuous learning process where linear learning is no more. Instead, multimodal experiences allow learners to seek, weigh, and communicate answers. Knowledge is found socially constructed based on existing knowledge*". Further work focuses on WUIM implementation in formal inclusive education classrooms to draw conclusions about peer collaboration regardless of their cognitive profile and the generalization of ADLs in real life.

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- Stavros Karakoutis (AR development, interfaces, user experience and programming)
- Evaggelia Koumantsioti (storyboard, photography and pedagogical agent)
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- Evaggelos Pandis (recordings, sound and video editing)
- Marinos Pavlidis (director, video shooting and editing)

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Ethical Considerations

According to the Declaration of Helsinki (World Medical Association Declaration of Helsinki, 2013), the project was approved by the Research Ethics and Conduct Committee of Ionian University (Ref. No. 4862/08-02-19) and the Greek Ministry of Education (Ref. No

Φ15/51675/58994/Δ1/15-04-2019), Scientific Council of the General Hospital of Florina (Ref. No 15/04-06-2020), Center for Creative Employment of Children with Disabilities of the Municipality of Florina (Ref. No 19/2019) and Association of Parents and Guardians of Children with Disabilities, "Sundberg" (Ref. No 20/22-06-2020). There is the written informed consent of children's parents and adults who participated in the project as well as written consent for display of the project participants on the photo material included in this publication.

References

Almeida, P., Abreu, J., Silva, T., Varsori, E., Oliveira, E., Velhinho, A., Fernandes, S., Guedes, R., & Oliveira, D. (2018). *Applications and Usability of Interactive Television*, *813*, 44-57. https://doi.org/10.1007/978-3-319-90170-1

Alper, M., & Herr-Stephenson, R. (2013). Transmedia Play: Literacy Across Media. *Journal of Media Literacy Education*, *5*(2), 366-369.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* (5th ed.). Washington, DC: American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Ayres, K. M., & Cihak, D. (2010). Computer- and video-based instruction of food-preparation skills: Acquisition, generalization, and maintenance. *Intellectual and Developmental Disabilities, 48*(3), 195-208. https://doi.org/10.1352/1944-7558-48.3.195

Baragash, R. S., Al-Samarraie, H., Alzahrani, A. I., & Alfarraj, O. (2020). Augmented reality in special education: a meta-analysis of single-subject design studies. *European Journal of Special Needs Education*, *35*(3), 382-397. https://doi.org/10.1080/08856257.2019.1703548

Barton, E. E., & Wolery, M. (2008). Teaching Pretend Play to Children With Disabilities: A Review of the Literature. *Topics in Early Childhood Special Education, 28*(2), 109-125. https://doi.org/10.1177/0271121408318799

Bernhaupt, R. (2010). User Experience Evaluation in Entertainment. In R. Bernhaupt (Ed.), *Evaluating User Experience in Games: Concepts and Methods. Human-Computer Interaction Series* (pp. 3-7). London: Springer. https://doi.org/10.1007/978-1-84882-963-3_1

Bernhaupt, R., & Mueller, F. F. (2016). *Game User Experience Evaluation.* Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '16 (pp. 940-943). San Jose, May 7 – 12. https://doi.org/10.1145/2851581.2856683

Bondy, A., & Frost, L. (1994). The Picture Exchange Communication System. *Focus on Autistic Behavior*, *9*(3), 1-19. https://doi.org/10.1177/108835769400900301

Booth, R., & Happé, F. (2010). "Hunting with a knife and ... fork": Examining central coherence in autism, attention deficit/hyperactivity disorder, and typical development with a linguistic task. *Journal of Experimental Child Psychology, 107*(4), 377-393. https://doi.org/10.1016/j.jecp.2010.06.003

Brooke, J. (1996). SUS: A "quick and dirty" usability scale. In P. W. Jordan, B. Thomas, B. A.Weerdmeester, & I. L. McClelland (Eds.), *Usability evaluation in industry* (pp. 189-194). London: Taylor & Francis.

Bruner, J. S., & Watson, R. (1983). *Child's talk: Learning to use language*. Oxford: Oxford University Press.

Caillois, R. (2001). *Man, Play, and Games*. Urbana: University of Illinois Press. http://voidnetwork.gr/wp-content/uploads/2016/09/Man-Play-and-Games-by-Roger-Caillois.pdf

CAST. (2018). *Universal Design for Learning Guidelines version 2.2*. Retrieved October 15, 2020, from http://udlguidelines.cast.org

Charlop, M. H., Lang, R., & Rispoli, M. (2018a). Lights, Camera, Action! Teaching Play and Social Skills to Children with Autism Spectrum Disorder Through Video Modeling. In M. H. Charlop, R. Lang, & M. Rispoli (Eds.), *Play and Social Skills for Children with Autism Spectrum Disorder* (pp. 71-94). Cham: Springer. https://doi.org/10.1007/978-3-319-72500-0_5

Charlop, M. H., Lang, R., & Rispoli, M. (2018b). More Than Just Fun and Games: Definition, Development, and Intervention for Children's Play and Social Skills. In M. H. Charlop, R. Lang, & M. Rispoli (Eds.), *Play and Social Skills for Children with Autism Spectrum Disorder* (pp. 1-16). Cham: Springer. https://doi.org/10.1007/978-3-319-72500-0_1

Corbett, B. A., & Abdullah, M. (2005). Video modeling: Why does it work for children with autism? *Journal of Early and Intensive Behavior Intervention*, *2*(1), 2-8. https://doi.org/10.1037/h0100294

Dalgarno, B., & Lee, M. J. W. (2010). What are the learning affordances of 3-D virtual environments? *British Journal of Educational Technology*, *41*(1), 10-32. https://doi.org/10.1111/j.1467-8535.2009.01038.x

Deliyannis, I., & Kaimara, P. (2019). Developing Smart Learning Environments Using Gamification Techniques and Video Game Technologies. In L. Daniela (Ed.), *Didactics of Smart Pedagogy* (pp. 285-307). Cham: Springer. https://doi.org/10.1007/978-3-030-01551-0_15

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). *From game design elements to gamefulness.* Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments (pp. 9-15). Tampere, September 28 – 30. https://doi.org/10.1145/2181037.2181040

Dewey, J. (1922). *Democracy and education: An introduction to the philosophy of education*. New York: Macmillan.

Fiorelli, G. (2013). *Transmedia storytelling: building worlds for and with fans*. Retrieved October 15, 2020, from https://moz.com/blog/transmedia-storytelling-building-worlds-for-and-with-fans

Fleming, L. (2013). Expanding Learning Opportunities with Transmedia Practices: Inanimate Alice as an Exemplar. *Journal of Media Literacy Education*, *5*(2), 370-377. https://files.eric.ed.gov/fulltext/EJ1043444.pdf

Fokides, E., Atsikpasi, P., Kaimara, P., & Deliyannis, I. (2019). Factors Influencing the Subjective Learning Effectiveness of Serious Games. *Journal of Information Technology Education: Research*, *18*, 437-466. https://doi.org/10.28945/4441

Fotaris, P., & Mastoras, T. (2019). *Escape Rooms for Learning: A Systematic Review*. Proceedings of the 13th European Conference on Game Based Learning (ECGBL) (pp. 235-243). Odense, October 3 – 4. https://doi.org/10.34190/GBL.19.179

Fowler, C. (2015). Virtual reality and learning: Where is the pedagogy? *British Journal of Educational Technology, 46*(2), 412-422. https://doi.org/10.1111/bjet.12135

Gee, J. P. (2008). Learning and games. In K. Salen (Ed.), *The Ecology of Games: Connecting Youth, Games, and Learning*. The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning (pp. 21-40). Cambridge, MA: The MIT Press. https://doi.org/10.1162/dmal.9780262693646.021

Goo, M., Therrien, W. J., & Hua, Y. (2016). Effects of computer-based video instruction on the acquisition and generalization of grocery purchasing skills for students with intellectual disability. *Education and Training in Autism and Developmental Disabilities*, *51*(2), 150-161.

Gray, C. A., & Garand, J. D. (1993). Social stories: Improving responses of students with autism with accurate social information. *Focus on Autistic Behavior*, *8*(1), 1-10. https://doi.org/10.1177/108835769300800101

Hehir, T., Grindal, T., Freeman, B., Lamoreau, R., Borquaye, Y., & Burke, S. (2016). *A Summary of the Evidence on Inclusive Education*. Cambridge, MA: Abt Associates.

Hersh, M., & Leporini, B. (2018). Editorial: Serious games, education and inclusion for disabled people. *British Journal of Educational Technology*, *49*(4), 587-595. https://doi.org/10.1111/bjet.12650

Kaimara, P., & Deliyannis, I. (2019). Why Should I Play This Game? The Role of Motivation in Smart Pedagogy. In L. Daniela (Ed.), *Didactics of Smart Pedagogy* (pp. 113-137). Cham: Springer. https://doi.org/10.1007/978-3-030-01551-0_6

Kaimara, P., Deliyannis, I., Oikonomou, A., & Miliotis, G. (2020). *Transmedia storytelling meets Special Educational Needs students: a case of Daily Living Skills Training*. Paper presented at the 4th International Conference on Creative Writing. Florina, September 14.

Kaimara, P., Fokides, E., Oikonomou, A., Atsikpasi, P., & Deliyannis, I. (2019). Evaluating 2D and 3D serious games: The significance of student-player characteristics. *Dialogoi! Theory and Praxis in Education*, *5*, 36-56. https://doi.org/10.12681/dial.20704

Kaimara, P., Fokides, E., Oikonomou, A., & Deliyannis, I. (2021). Potential Barriers to the

Implementation of Digital Game-Based Learning in the Classroom: Pre-service Teachers' Views. *Technology, Knowledge and Learning*. https://doi.org/10.1007/s10758-021-09512-7

Kaimara, P., Miliotis, G., Deliyannis, I., Fokides, E., Oikonomou, A., Papadopoulou, A., & Floros, A. (2019). Waking-up in the morning: A gamified simulation in the context of learning activities of daily living. *Technology and Disability*, *31*(s1), 195-198. https://doi.org/10.3233/TAD-190015

Kaimara, P., Oikonomou, A., & Deliyannis, I. (2020). Design transmedia learning environments for inclusive education (in greek: Σχεδιασμός διαμεσικών μαθησιακών περιβαλλόντων για τη συνεκπαίδευση). *Διάλογοι! Θεωρία Και Πράξη Στις Επιστήμες Αγωγής Και Εκπαίδευσης*, *6*, 239-286. https://doi.org/10.12681/dial.23330

Kaimara, P., Oikonomou, A., Deliyannis, I., Papadopoulou, A., Miliotis, G., Fokides, E., & Floros, A. (2021). Waking Up In the Morning (WUIM): A Transmedia Project for Daily Living Skills Training. *Technology and Disability*, *33*(2),137-161. https://doi.org/10.3233/TAD-200326

Kanellopoulou, C., Kermanidis, K. L., & Giannakoulopoulos, A. (2019). The Dual-Coding and Multimedia Learning Theories: Film Subtitles as a Vocabulary Teaching Tool. *Education Sciences*, *9*(3), 210. https://doi.org/10.3390/educsci9030210

Ke, F. (2016). Designing and integrating purposeful learning in game play: a systematic review. *Educational Technology Research and Development*, *64*(2), 219-244. https://doi.org/10.1007/s11423-015-9418-1

Kolb, A. Y., & Kolb, D. A. (2009). Experiential learning theory: A dynamic, holistic approach to management learning, education and development. *The SAGE Handbook of Management Learning, Education and Development*, 42-68. https://doi.org/http://dx.doi.org/10.4135/9780857021038.n3

Kosmadoudi, Z., Lim, T., Ritchie, J., Louchart, S., Liu, Y., & Sung, R. (2013). Engineering design using game-enhanced CAD: The potential to augment the user experience with game elements. *Computer-Aided Design*, *45*(3), 777-795. https://doi.org/10.1016/j.cad.2012.08.001

Kuo, R., Chang, M., Lyu, C. W., & Heh, J. S. (2013). A pilot study of the situated game for autistic children learning activities of daily living. *Research & Practice in Technology Enhanced Learning*, *8*(2), 291-315.

Lillard, A. S. (2013). Playful learning and Montessori education. *American Journal of Play*, *5*(2), 157-186.

Mcmahon, D. D. (2014). *Augmented Reality on Mobile Devices to Improve the Academic Achievement and Independence of Students with Disabilities.* (Doctoral dissertation, University of Tennessee, Knoxville). Retrieved from https://trace.tennessee.edu/utk_graddiss/2716

Mechling, L. (2008). High tech cooking: A literature review of evolving technologies for teaching a functional skill. *Education and Training in Developmental Disabilities*, *43*(4), 474-485.

Moreno, R., & Mayer, R. (2007). Interactive Multimodal Learning Environments. *Educational Psychology Review*, *19*(3), 309-326. https://doi.org/10.1007/s10648-007-9047-2

Moreno, R., Mayer, R. E., & Lester, J. C. (2000). *Life-Like Pedagogical Agents in Constructivist Multimedia Environments: Cognitive Consequences of their Interaction.* Proceedings of ED-MEDIA 2000-World Conference on Educational Multimedia, Hypermedia & Telecommunications (pp. 776-781). Montreal, June 26 – July 1.

Oliver, M. (2004). The social model in action: If I had a hammer. In C. Barnes, & G. Mercer (Eds.), *Implementing the Social Model of Disability: Theory and Research* (pp. 18-31). Leeds: Disability Press.

Ontario Ministry of Education. (2013). *Learning for All: A Guide to Effective Assessment and Instruction for All Students, Kindergarten to Grade 12*. Retrieved from http://www.edu.gov.on.ca/eng/general/elemsec/speced/LearningforAll2013.pdf

Panagopoulos, I. (2019). *Reshaping Contemporary Greek Cinema Through a Re-evaluation of the Historical and Political Perspective of Theo Angelopoulos's Work.* (Doctoral dissertation). University of Central Lancashire, Preston.

Park, J., Bouck, E., & Duenas, A. (2019). The Effect of Video Modeling and Video Prompting Interventions on Individuals With Intellectual Disability: A Systematic Literature Review. *Journal of Special Education Technology*, *34*(1), 3-16. https://doi.org/10.1177/0162643418780464

Pence, H. E. (2011). Teaching with Transmedia. *Journal of Educational Technology Systems*, *40*(2), 131-140. https://doi.org/10.2190/ET.40.2.d

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of Game-Based Learning. *Educational Psychologist*, *50*(4), 258-283. https://doi.org/10.1080/00461520.2015.1122533

Pratt, C., & Steward, L. (2020). *Applied behavior analysis: the role of task analysis and chaining.* Retrieved October 15, 2020, from https://www.iidc.indiana.edu/pages/Applied-Behavior-Analysis

Pratten, R. (2011). *Getting started with transmedia storytelling: A practical guide for beginners.* Retrieved October 15, 2020, from https://talkingobjects.files.wordpress.com/2011/08/book-2-robert-pratten.pdf

Prensky, M. (2007). *Digital game-based learning*. St. Paul, Minnesota: Paragon House.

Quintero, J., Baldiris, S., Rubira, R., Cerón, J., & Velez, G. (2019). Augmented Reality in Educational Inclusion. A Systematic Review on the Last Decade. *Frontiers in Psychology*, *10*(1835), 1-14. https://doi.org/10.3389/fpsyg.2019.01835

Ramadan, R., & Widyani, Y. (2013). *Game development life cycle guidelines.* Paper presented at the 2013 5th International Conference on Advanced Computer Science and Information Systems (ICACSIS) (pp. 95-100). Bali, September 28 – 29.

https://doi.org/10.1109/ICACSIS.2013.6761558

Ramdoss, S., Lang, R., Fragale, C., Britt, C., O'Reilly, M., Sigafoos, J., Didden, R., Palmen, A., & Lancioni, G. E. (2012). Use of computer-based interventions to promote daily living skills in individuals with intellectual disabilities: A systematic review. *Journal of Developmental and Physical Disabilities, 24*(2), 197-215. https://doi.org/10.1007/s10882-011-9259-8

Sadoski, M. (2005). A Dual Coding View of Vocabulary Learning. *Reading & Writing Quarterly*, *21*(3), 221-238. https://doi.org/10.1080/10573560590949359

Salen, K., & Zimmerman, E. (2004). *Rules of Play - Game Design Fundamentals*. Cambridge, MA: Massachusetts Institute of Technology. https://gamifique.files.wordpress.com/2011/11/1-rules-of-play-game-design-fundamentals.pdf

Selvanathan, R. G. (2012). Measuring Educational Sustainability. *International Journal of Higher Education, 2*(1), 35-43. https://doi.org/10.5430/ijhe.v2n1p35

Shepley, S. B., Spriggs, A. D., Samudre, M., & Elliot, M. (2018). Increasing Daily Living Independence Using Video Activity Schedules in Middle School Students With Intellectual Disability. *Journal of Special Education Technology*, *33*(2), 71-82. https://doi.org/10.1177/0162643417732294

Sims, R. (2000). An interactive conundrum: Constructs of interactivity and learning theory. *Australasian Journal of Educational Technology*, *16*(1), 45-57. https://doi.org/https://doi.org/10.14742/ajet.1821

Sloan, M. C. (2010). Aristotle's Nicomachean Ethics as the Original Locus for the Septem Circumstantiae. *Classical Philology*, *105*(3), 236-251. https://doi.org/10.1086/656196

Steinböck, M., Luckner, N., Kayali, F., Proyer, M., & Kremsner, G. (2019). *Cologon*. Proceedings of the 14th International Conference on the Foundations of Digital Games - FDG '19 (pp. 1-5). San Luis Obispo, August 26 – 30. https://doi.org/10.1145/3337722.3341834

Thomas, S., Schott, G., & Kambouri, M. (2004). Designing for learning or designing for fun? Setting usability guidelines for mobile educational games. In J. Attewell, & C. Savill-Smith (Eds.), *Learning with mobile devices: A book of papers* (pp. 173-181). London: Learning and Skills Development Agency.

Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. R., Brimijoin, K., Conover, L. A., & Reynolds, T. (2003). Differentiating Instruction in Response to Student Readiness, Interest, and Learning Profile in Academically Diverse Classrooms: A Review of Literature. *Journal for the Education of the Gifted*, *27*(2-3), 119-145. https://doi.org/10.1177/016235320302700203

Trondsen, E. (2019). *Augmented/Virtual Reality in Nordic/Baltic Education, Learning and Training.* Silicon Vikings. Retrieved from https://www.innokas.fi/wp-content/uploads/2019/04/Nordic-Baltic-XR-Edu-Report_3-2019.pdf

Tsikinas, S., & Xinogalos, S. (2019). Studying the effects of computer serious games on people with intellectual disabilities or autism spectrum disorder: A systematic literature review. *Journal of Computer Assisted Learning, 35*(1), 61-73. https://doi.org/10.1111/jcal.12311

UNESCO. (1994). *World Conference on Special Needs Education: Access and Quality (Salamanca, Spain, June 7-10, 1994). Final Report*. Paris: United Nations Educational, Scientific and Cultural Organization & International Bureau of Education.

United Nations. (1948). *Universal Declaration of Human Rights (UDHR)*. Retrieved October 15, 2020, from https://www.un.org/en/universal-declaration-human-rights/

United Nations. (2017). *General Comment on Article 19. Living independently and being included in the community*. Committee on the Rights of Persons with Disabilities. Retrieved October 15, 2020, from https://digitallibrary.un.org/record/1308076

van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R., & Valentino, J. (2010). A Comparison of Picture and Video Prompts to Teach Daily Living Skills to Individuals With Autism. *Focus on Autism and Other Developmental Disabilities*, *25*(4), 195-208. https://doi.org/10.1177/1088357610380412

Verenikina, I. (2008). Scaffolding and learning: Its role in nurturing new learners. In P. Kell, W. Vialle, D. Konza, & G. Vogl (Eds.), *Learning and the learner: exploring learning for new times* (pp. 161-180). Wollongong: University of Wollongong. https://ro.uow.edu.au/edupapers/43/

Warren, S. J., Wakefield, J. S., & Mills, L. A. (2013). Learning and Teaching as Communicative Actions: Transmedia Storytelling. In L. Wankel, & P. Blessinger (Eds.), *Increasing student engagement and retention using multimedia technologies video annotation, multimedia applications, videoconferencing and transmedia storytelling* (pp. 67-94). Bradford: Emerald Group Publishing Limited. https://doi.org/10.1108/S2044-9968(2013)000006F006

Wehmeyer, M. L. (2006). Beyond Access: Ensuring Progress in the General Education Curriculum for Students with Severe Disabilities. *Research and Practice for Persons with Severe Disabilities*, *31*(4), 322-326. https://doi.org/10.1177/154079690603100405