

„Play and Learn“, Video Games and Digital Play in Early Childhood Educa- tion

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Abstract. “Play and Learn”, Digital Video Game in Early Childhood Education, explores the possibilities of video game localization, digital game-based learning (DGBL) and software design, i.e., video games for early childhood education, for children aged 2 to 6. When designing a video game, a special focus is on the cultural and linguistic adaptation of the game. The game design is intended to use multiple models – to be based on story (narrative), audio and visual information in order to engage children whose native language is Serbian. The use of the native, local, language is important for a more accessible and understandable transfer of tasks and the interaction between the child and the video game itself. The adoption of DGBL technologies has transformed early childhood education by introducing interactive tasks adapted to the learning and age of children on mobile devices and mobile devices. The first part of this paper shows that educational video games improve children's motivation and creativity, and also encourage mutual cooperation in solving given problems. The second part of the paper presents the pedagogical framework adopted when designing the game. The third part answers the question of why cultural and linguistic localization is important. And the fourth part presents the preschool educational game "Play and Learn" (in Serbian “Igraj i uči”) that integrates the presented pedagogical principles and the importance of linguistic localization. integration of pedagogical principles, user-friendly interfaces and developmental appropriateness. Moreover, cultural and linguistic localization plays a key role in maximizing educational impact, because children learn best in their native language and therefore localized educational games can strengthen the child's personality, increase his understanding of the given problem and provide more interesting learning experiences.

Keywords: Educational video game, Early childhood education, Serbian Language localization.

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1 Developmental Benefits and Learning Outcomes of Digital Game-based Learning

Digital game-based learning (DBL) has positive effects on young children's development in several areas. A systematic review of educational video games by Alotaibi [1] concluded that early childhood game-based learning has moderate to large positive effects on cognitive, social, and emotional outcomes, and on children's motivation and engagement.

Educational videogames can:

- Strengthen children's cognitive skills – reasoning and problem-solving abilities;
- Games often exercise memory, attention, and logic. For example, digital play can foster early language skills, mathematical reasoning, and spatial cognition in preschoolers.
- Improve critical thinking, creativity, and problem-solving when children engage in well-designed learning games.

One literature review noted that DGBL has “has the potential to create new forms of childhood learning” [2].

In some games, we have digital guides that help the child in the process of playing and encourage team play. By solving joint tasks in games, children develop social intelligence – connecting with peers, respecting the rules of turn-taking and resolving conflict during the game [3]. It is also desirable that certain elements of the game, in addition to developing social intelligence, be designed to develop emotional intelligence in children. For example, interactive stories (similar to classic children's fairy tales) can foster skills in managing emotions, expressing themselves and understanding each other. Papoutsis et al., evaluated the serious game “The Park of Emotions” and experimentally validates as an effective intervention tool, highlighting the importance of implementing digital games aimed at improving emotional intelligence and emotional skills throughout childhood and preadolescence [4]. Engaging, playful context of games often keeps children motivated and persistently involved, which may further support emotional regulation. Researchers have observed that children can be more engaged and stay on-task longer during digital play than in some traditional activities [5].

Digital games can contribute to both motor skills and physical activity if the development of the games was properly designed. Many preschool games require tapping, dragging, or drawing on touchscreens, which can help refine fine motor control and hand-eye coordination—children with frequent tablet use in early toddlerhood showed significantly better performance on fine motor assessments than non-users [6]. Some evidence suggests that interactive tablet play can improve these skills, though findings are mixed and dependent on usage patterns. Notably, active video games encourage physical movement. One study found that exergaming, that refers to active video games that are also a form of exercise, encourage physical movement in preschool-aged children [7]. Video games or applications for mobile phones that are based on movement (dancing, exploring nature, or applications that help with exercise) require children to actively, physically, participate in the tasks.

Educational games are designed to, in addition to physical engagement, also strengthen early skills such as writing and numeracy. For example, game-based literacy

applications have successfully supported the development of reading skills in preschool children, in accordance with the cultural and other requirements of the specific target environment [8]. Math-oriented games can teach counting, shapes, and basic problem-solving in an engaging format [9]. Research indicates that well-designed games can improve young children's knowledge in areas like vocabulary, letter recognition, and basic math, often by embedding learning objectives within play tasks [10]. Some studies have specifically targeted creativity—for instance, a digital game called Thinking Paradise was developed to train preschoolers' creative thinking, yielding improvements across fluency, originality, elaboration, anti-block, and title scores in the Torrance Test [11]. Game-based learning must be aligned with the pace of children's development as well as with the curriculum and program for preschool children. An interactive approach to teaching, unlike the traditional one, can contribute to greater success in mastering the material and greater engagement of children. Video games can make learning fun and interactive, because the process itself is seen as a form of entertainment.

The design of video games in early childhood must be of high quality and have a clear context. The emphasis should be on purposefulness, that they be appropriate to the child's developmental level and that they be used according to the instructions of the educator. Educators have a role in selecting appropriate educational content, encouraging teamwork, but also in being aware of the needs of each individual child and, based on those needs, scaling the difficulty of the game. With these supports in place, the consensus of recent literature is that digital play can be a valuable tool to promote children's learning and development in the early years [[12], [1]].

2 Psychological Frameworks: Piaget and Vygotsky

Classic child development theories provide a useful lens for understanding why play – including digital play – is so critical in the preschool years. Both Jean Piaget and Lev Vygotsky viewed play as a fundamental, “building block” activity through which children construct knowledge. As Piaget emphasized, intelligence is an adaptation that develops through organization and assimilation of experiences, with play acting as a key mechanism for symbolic capacity and cognitive growth [13]. Similar to Piaget, Vygotsky argued that play allows children to act “beyond their average age” by engaging in activities that expand their abilities with social support (with the help of educators).[14] The process of play (with physical toys or video games) allows young children to experiment, as they have complete freedom to interpret the world in their own way. This process of cognitive maturation is essential for later skills such as reading, writing, or arithmetic.

Piaget's theory deals with the progression of children through different stages of cognitive development – for example, preschoolers (aged around 2–6 years) are in the preoperational stage, which is characterized by intuitive thinking and symbolic play [13]. At this stage, children learn best through concrete, sensory experiences and active exploration. Piaget explained that intelligence builds upon sensorimotor activity and gradually develops into operations that allow for logical thinking [13]. Digital video games, in order to be in line with Piaget's principles, should have visually appealing

content and the possibility of direct manipulation of the game content that would suit the child's developmental level. For example, the game can use basic and strong colors, clear and stylized drawings, and the game interface itself should be intuitive, i.e. clear enough for the child to use. All of these elements should attract the attention of young children. Piaget also defined assimilation and accommodation as two key processes by which children learn: they assimilate, adopt, new experiences into existing frameworks and adapt to their own frameworks when new experiences challenge previous structures [13]. Educational video games can support both assimilation and accommodation by allowing children to repeat actions, experiment, and receive feedback. As Piaget states - children are "little scientists" who learn through trial and error because the interactive and exploratory nature of educational video games enables them to do so.

Vygotsky adds that social interaction is also important for cognitive progress. He introduced the concept of the Zone of Proximal Development (ZPD) – the range of tasks a child cannot do alone but can accomplish with guidance from a more skilled partner [14]. Play creates an ideal context for such guided participation. In his view, during play “a child always behaves beyond his average age,” stretching to new skills with the help of others. This idea of scaffolding is central: when a caregiver or teacher plays alongside the child, asks questions, or gives hints, digital play becomes a scaffolded activity that pushes the child's learning forward. Van der Veer [15] explains that Vygotsky saw language and thought as merging in early childhood, where children first repeat instructions aloud before internalizing them as inner speech. This process transforms play into a powerful context for problem solving and self-regulation.

There is evidence that well-designed educational software can facilitate this adult-child interaction. For instance, literacy games such as Alphablocks show, a British pre-school television series featuring animated letter-characters in Alphaland, that when adults guide children during gameplay, it creates a “meeting of minds” where both builds meaning together. This directly reflects Vygotsky's idea that learning is socially co-constructed [15]. Role-playing games – whether in a physical or digital environment – allow children to practice following rules, taking on roles, and abstract thinking, which Vygotsky linked to the development of higher mental [14] functions.

Piaget suggests that educational games should be concrete, but also intuitive and exploratory to suit the developmental level of preschool children, while Vygotsky emphasizes social interaction and the role of language in learning. When designing educational video games, both views should be taken into account: they should be interactive and encourage independence in the child, but also require teamwork and adult participation. This blend maximizes learning within the child's developmental stage and translates foundational child development principles into practical digital learning design.

3 Cultural and Language Localization of Video Game

When designing video games for use in early childhood education, the cultural and linguistic context of children's play should be taken into account. Research has shown that young children learn best in their native language and within the family setting. UNESCO notes that “evidence tells us that learning first in one's mother tongue leads

to better outcomes in the future – for individuals, cultures, and nations” [16]. In practical terms, this means an educational game for Serbian preschoolers will be most effective if its language is Serbian and it reflects Serbian cultural context. Using the child’s mother tongue not only improves comprehension and learning of content, but also affirms the child’s identity and comfort, making the learning experience more natural [[17], [18]].

For young children, who have not yet developed basic language skills, games should provide narration, accompanying audio instructions, and text in their native language. For example, if a game was first developed for an English-speaking area, it is easiest to simply translate the words into Serbian. However, effective localization goes further - it can include using common Serbian nursery rhymes, local names, or voices with familiar accents to make the game seem like the source. The goal is to have the child engage with the content without language being a barrier. This is supported by guidelines in early education that initial literacy and learning activities be conducted in the child’s first language whenever possible [8]. For example, a game that teaches letters would be designed around the Serbian alphabet – in Cyrillic and Latin script for children from the Serbian-speaking area. It should also include specific characters Đ, Č, Š, etc., and how they would be pronounced by a Serbian teacher or parent.

Stories, characters, and overall visuals are often the most important elements of children’s play. These elements should be aligned with the child’s cultural background as they can significantly increase their engagement. The story, themes, and characters that appear in the games should be inspired by literary works by recognized local authors or from historical sources and folk tales. For example, a game for children from the Serbian-speaking area may include: local animals (such as hedgehogs or bears that are common in Serbian children’s stories), traditional motifs or folkloric characters, or scenarios such as the setting of a “Slavic fairy tale” that Serbian children may recognize from books and cartoons [[19], [20]]. The use of local cultural sources can make the game more interesting for the child, as they recognize parts of the world around them.

At the same time, designers should be mindful of cultural neutrality vs. specificity. A study by Nikolopoulou [8] on early childhood software localization pointed out that some features of software are easier to localize than others. Software with a “dominance of pictures, animation and sound, [and] culture-independent content” and with neutral interfaces and storylines can be more readily adapted to different countries. In other words, using universally appealing imagery (like basic shapes, happy cartoon animals) and avoiding highly culture-specific references can ease localization to multiple languages. However, to truly connect with a target culture, certain customizations are beneficial – such as including a few locally loved songs or cultural references that make the experience unique for that audience. It’s a balance: core educational content might remain the same globally (e.g. counting apples), but the style and context can be tweaked to fit local expectations and curricular needs. For example, if a game teaches about foods, a Western version might use apples and pizza, whereas a localized Serbian version might include plums and pita bread to reflect foods children recognize [[17], [18]].

Localization in educational games for early childhood is not just translation – it’s cultural adaptation. Ensuring the game speaks the child’s language (literally and

figuratively) can improve both learning outcomes and enjoyment. As a child's right, early education in the mother tongue is recommended, and this extends to digital learning tools. Game developers and educators should thus collaborate to create or adapt games that align with local languages and cultures [[21], [10]].

4 „Play and Learn“

The educational video game "Play and Learn" (in Serbian "Igraj i uči") was developed at the Metropolitan University, center in Niš, within the Laboratory for Video Games during the year 2025 and is continuously being developed. The game is designed as a modular platform, which will be developed in the coming years and will represent a long-term and creative project of the laboratory. The development team consisted of associate professor dr. Petar Pejić, assistant Miloš Nikolić and a group of fourth-year students from the Faculty of Information Technologies (study program: Video Game Development) and the Faculty of Digital Arts (study program: Graphic Design). The collaboration between students from two different faculties is reflected in the integration of the technical, software, side of the project with original visual and audio design. Joint work, which is part of the students' professional practice, contributed to the successful realization of the video game "Play and Learn".

The video game was developed in the Unity game engine and is optimized for Android mobile devices, making it easily accessible to preschoolers. The entire visual identity (see Fig. 1) was originally created by students of the Faculty of Digital Arts. The narration and music in the game have also been adapted to provide an authentic and culturally localized experience in the Serbian language. The game has a two-dimensional visual style that is suitable for children, with colorful and rounded shapes and interactive elements that are suitable for children aged 2 to 6 years (see Fig. 2). Game design emphasizes simplicity, recognition and positive emotional engagement. "Play and Learn" is organized as a modular island system. Each island represents a different thematic unit (e.g. pirates, winter) and contains 6 to 12 minigames. This structure provides a variety of experiences while maintaining a clear pedagogical framework and lends itself to future content expansion.

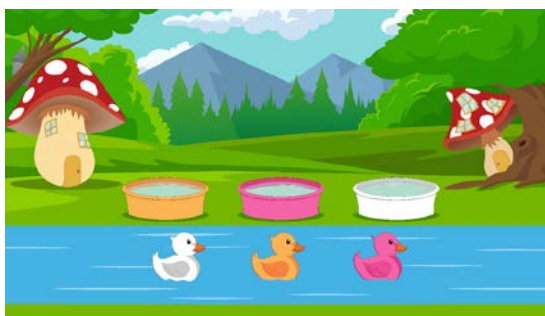


Fig. 1. Visual identity of video game "Play and Learn".



Fig. 2. Two-dimensional visual style that is suitable for children of video game “Play and Learn”.

Children interact primarily through the mechanisms of dragging, arranging and selecting objects. These mechanics support the development of fine motor skills and logical thinking. Currently, there are three basic types of mini-games: assembling shapes (children drag and join geometric figures into correct patterns, see Fig. 3); shape matching and color matching (children group objects based on color associations); and order of sizes (children arrange objects according to relative size which encourages pattern recognition). All these tasks are intuitive, not non-verbal, and are aligned with the developmental levels of preschool children.



Fig. 3. Drag and join geometric figures into correct patterns suitable.

Unlike most preschool games that focus on mastering language and numeracy, “Play and Learn” emphasizes: development of motor skills (fine hand-eye coordination through mechanisms of dragging and arranging elements); pattern recognition (shape, size, color); and cognitive flexibility and problem solving (choosing correct schedules).

The game is based on the theories presented by Piaget and Vygotsky. According to Piaget's theory, children aged 2 to 6 learn best through concrete tasks, sensory and symbolic play. Game also supports (as already described in the paper) the process of assimilation and accommodation where the child learns by repeating actions, experimenting with solutions and having the availability of immediate feedback. From a Vygotsky

point of view, the design also supports the Zone of Proximal Development – children can perform tasks independently, but also adults can guide them through their mastery.

The game is currently free to download and available for families and educators. Pilot testing with preschool children is planned, which will provide empirical feedback on the effectiveness of the game and on future improvements. The game is conceived as a laboratory platform that future generations of students will build on, with new islands and mini-games, as well as new visual identities for those parts of the game. The upcoming expansion will include additional themes, new mechanics and potential localization into other languages if the game proves successful in Serbia.

5 Conclusion

"Play and Learn", Video Games and Digital Play in Early Childhood Education is an analysis of video game-based learning and its localization. The paper highlights the potential of video games as a tool for education, and their fun and interactive approach to imparting knowledge and skills. Video games, viewed as multimodal products, require careful translation and localization to ensure accessibility and engagement of children. The prevalence of mobile phones and tablets makes digital learning based on video games accessible to a wider group of users. Thanks to well-designed mechanics, these games can improve children's motivation, stimulate their creativity, and develop problem-solving and collaboration skills. Of course, content control by parents or educators is always needed, because due to their design, problems such as overuse must be taken into account.

Cultural and linguistic localization, in our case into the Serbian language, appear as a key factor in improving the educational value of preschool games. This requires the integration of local languages in which the video game will be used, the adoption of local narrative and cultural elements in the game design.

The video game "Play and Learn" is designed for educational purposes in early childhood. It combines well-thought-out pedagogical design, child-friendly interfaces and cultural and linguistic localization of the Serbian-speaking area. Collaboration between experts (educators, psychologists, linguists and game designers) allows for the creation of engaging, developmentally appropriate and culturally relevant digital learning environments.

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