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# Interactive Analysis of Children's Video Game Products

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**Abstract:** Much prior research has advanced the theory of learning based on games in light of the industry's economic prosperity. This paper examines how interactive video games for young children have evolved. Video games have long been a topic of debate in discussions about how children develop, although the effects of playing them remain ambiguous. One drawback of earlier research is that it frequently concentrates on adults' and school students' game-based learning. Young children will inevitably enter the realm of video game education, given the prevalence of smartphones. This study examines how game interaction is played in the market for children's video games while attempting to combine the theory of children's learning and cognition. The analysis model is made to map the software's interaction structure. Then, a comparison and overview of issues in the markets for children's video game software will occur. We found that building interactive systems for video game interfaces takes into account a wider variety of real-life interactions. By establishing the approach of interactive evaluation of children's video games, we hope to bring fresh perspectives to the future development of children's video games.

**Keywords:** Child Development, Video games, Interactive design

## 1. Introduction

When a human's material requirements are met mainly, they begin to engage in games, which, along with work, make up daily life (Sailer et al., 2017). Games have their roots in real-world business and military training (Harteveld, 2011; Farah, 2021). The essence of a video game, in contrast to other games, is the player's involvement with an intangible, underlying experience whose physical characteristics are, at best, a means of addressing it (Ghamari-Tabrizi, 2000). The connection between the player and the physical medium is the essence of most games (Pérez & Sánchez Coterón, 2013).

Invariably, the game's core controls its outcome rather than its side effects (Fabricatore, 2007). In the design of video games, it is not the design of the game's look, interface, or special effects that s most important. The video game's vital core is the interaction structure's design (Pinelle & Wong, 2008); (Dickey, 2006). This paper is dedicated to the study of whether the design of interaction structures in the interaction design of video games is humane and appropriate to children's developmental levels.

Successful game design must go beyond intuitive judgment and rash behavior (Tinghög et al., 2016). This is because the designers must follow specific design process guidelines. Only by unifying the design guidelines of a game can a flexible development practice be based on them. A game's design may only be flexibly developed if it is based on (Takeuchi & Nonaka, 1986; Breuer & Bente, 2010). The study's findings indicate that children's development is favorably impacted by number play (Blumberg et al., 2019). The basic design guidelines pursued in this study are to respect children's developmental patterns and cognitive levels.

## 2. Review of empirical evidence

Our perspective is empirical. It connects early childhood learning theories to video game theory. The results imply that playing video games may enhance various cognitive and psychomotor functions. Close and long-distance transfers from video games to outside chores happen if they play video games (Tobias et al., 2014). Learning is the process of transferring knowledge from the outside to the inside, claim O'Dell and Grayson (1998). To identify appropriate criteria for children's video games, we attempt to assess a child's video game product and can begin with empirical evidence. Research by Coleman and Money (2020) demonstrates that without comprehension of the instructional components in games Without knowing the game's educational components and the student's current learning environment, it is challenging to assess the entire usefulness of digital games. The distinctiveness of game-based learning is difficult to identify on an epistemic level, as is evident from a brief assessment of existing games. Behaviorist, cognitivist, and constructivist components are all used by game designers. Video games are frequently offered in several configurations (Plass et al., 2015).

Children have learning chances thanks to games. At a deeper level, they take in knowledge from numerous sources and act rapidly. Do not even request for the rules; infer them from the game. Cooperate with others more (Hussein et al., 2019). According to Spires (2015), game-based learning involves more than just creating games for students to play; it also entails creating interactive learning activities that may gradually introduce concepts and guide them toward their intended outcomes. The use of games in education is called game-based learning (Pivec, 2009). Students can interact with instructional resources and disciplines in a dynamic, entertaining, and gamified way because to the motivating psychology inherent in gamified learning (Anastasiadis et al., 2018). We also think that the same approach can be applied to young children.

## 3. Overview of interaction design research

In accordance with Moore's Three Interaction Types (1989). In this study, we combined video game characteristics with criteria for children's cognitive development. The three types of engagement were altered to behavioral, sensory, and emotional interaction. Although every child has sensory and perceptual abilities from birth, he or she needs engage in interaction to achieve sensory unity (Ayres & Robbins,2005). In light of the above discussion, we should consider the interactive experience of video games from a developmental standpoint for children.

Most studies emphasize human-computer interaction; There is little research examining teacher-student interaction (Blumberg et al., 2019). The three common interaction elements are human, interface, and machine/system. The three most important aspects of user experience design are form, behavior, and content (Helander, 2014). The most crucial part is behavior interaction, namely interaction design (Kreijns et al., 2003). In words, interaction is a behavior. Interaction design is about designing behavior in the user experience. It is concerned with how behavior relates to forming and content. Designers must study the user's knowledge system and personal habits to design products tailored to people's daily work and life habits and the end user. The standard of interaction design is to aim for user experience, to care about user involvement, and to bring about a deeper level of user involvement. The standard for interaction design is to aim for user experience, to care about user engagement, and to aim for a deep, immersive experience for the user, which is currently better done by creating new experiences through narrative and emotional connections. Venn diagrams are used in this study to represent the relationships. As shown in Figure 1. interaction design, as an interdisciplinary cross-discipline, combines many disciplines and ideas.

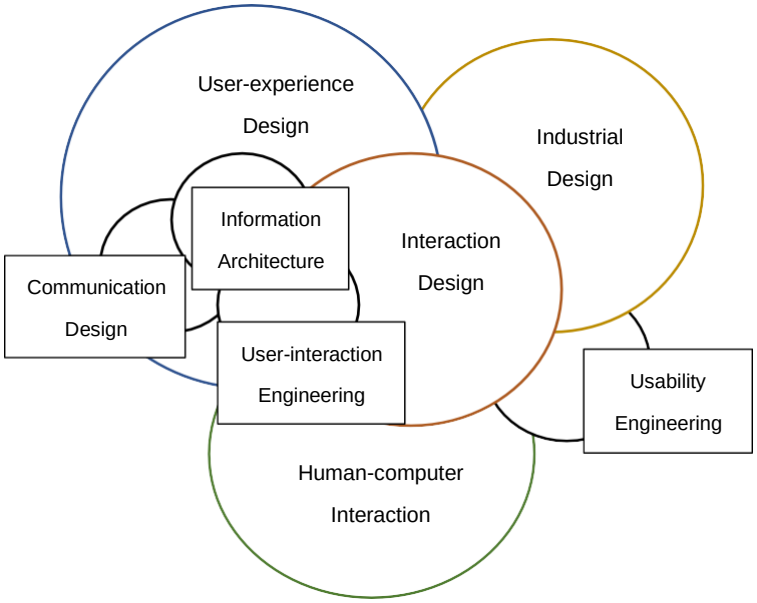



*Figure 1.* Venn diagram of the interactions design multidisciplinary.

Harsh and Sohail (2002) design research uses a team to manage a series of iterative cycles of educational design, implementation, and evaluation to provide readers with an observation of an adult distance education program in Malaysia. Social constraints and affordances influence conceptual systems and technology. Re-conceptualizing the field of mathematics education research as a design science akin to engineering and other emerging interdisciplinary fields involving the interaction of "subjects" (Lesh & Sriraman, 2005). These methods are examined and reconceptualized through a wide range of academic work. These methods' pedagogical usability reveals their purpose, value, and alignment with the school curriculum (Tzuo, 2012). Yusoff et al. (2018) Review relevant articles on educational games and the role of games as interaction design tools that influence the cognitive, emotional, and social skills students interact with when playing games. Social interaction is the basis for achieving goals. Children's emotional responses to robot-based experiences are expressed in their social behavior toward each other (Caceffo et al., 2022).

## 4. Overview of the use of children's video game products

Studies show that most school-age children in the United States play video games, computer games, or both (Williams, 2006). The popularity of video games is the highest in Finland, and around 90% of Finnish children play video games regularly (Subrahmanyam & Renukarya, 2015). As of January 2022, according to Statista, there are 107 iOS apps in the Apple App Store alone, with the games category ranked second. YouTube Kids and Facebook Messenger Kids are mobile apps for children found to collect the most data from iOS users worldwide. An analysis of the literature reveals that children's access to video game products is quite common in society, and children's use of digital electronic products for gaming is also commonplace.

Early childhood is the most rapid period of brain development in children. Lin (2008) regards unconscious memory as predominating in early childhood. Anything enjoyable, memorable, and robust to the child is easily remembered. Figurative memory is preferred to logical memory. (Ronald & Mariellen, 1975) also agree with Kohlberg that the moral development of young children is at a pre- customary level and that moral values are judged primarily by external demands. During the developmental stages of childhood, children are exposed to either face-to-face play with peers in the real world or video games in the virtual world. According to Piaget's game stage theory of children's play, the level of space development is commensurate with the child's intellectual development. The emphasis in the design of children's video games is on suitability for children's cognition. The focus is more on the child's experience during the game. The design intention should meet the child's psychological desires and satisfy the child's desire to achieve goals. It should be designed to stimulate

the child's interest so that the child can achieve a higher level of self-actualization in the video game rather than simply becoming addicted to it.

## 5. An analytical framework for children's video games

This study attempted to develop a sound framework for analyzing video games for preschool children. We used a mixed-methods approach to analyze the framework-building process, and our analysis was theory-driven and bottom-up. We attempted to build and integrate with the play research literature in game design by reviewing several game analysis systems and conducting participatory observations and interventions.

First-level analysis structure: The structure of the relationship between input and output in children's video games, mainly between children and mobile application products, is illustrated in Figure 2.

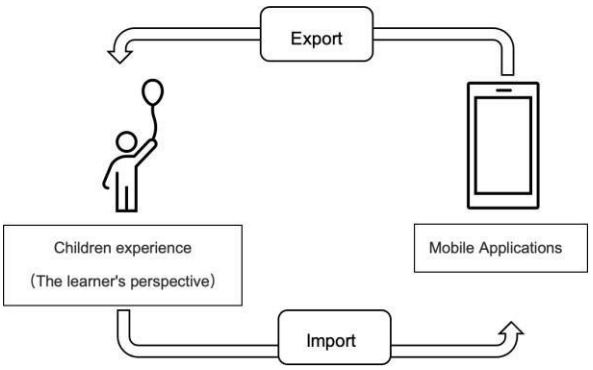



*Figure 2.* Children's video game interaction level architecture.

Secondary analysis structure: The usual output methods for mobile app-based products are mainly visual, auditory, tactile, and sensory. Children Children's information input is in the form of gestural touch swipes, sound, and gravity sensing. As shown in Figure 3.

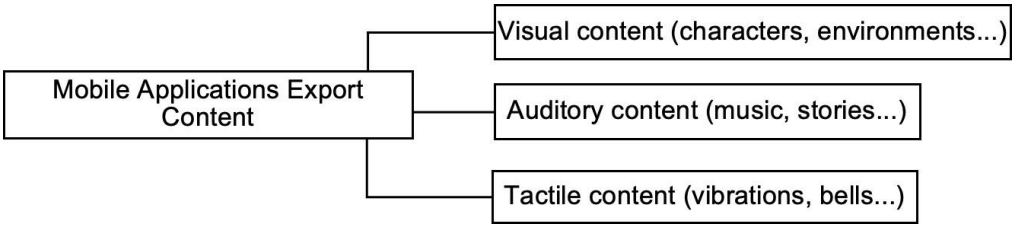



*Figure 3.* Elements of the system Export.

Three-level analysis architecture: Children's participation in class can be judged by behavior, sense, and emotion (Furrer & Skinner, 2003). Our research will also formulate an analysis table of interaction levels of preschool children's video game products according to these three aspects, as shown in Table 1. It will also extend into the details of the analysis scale.

Table 1. *Interactive Hierarchical Analysis of Children's Video Game Product*

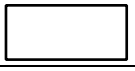
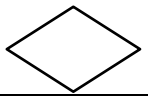
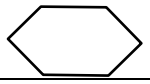
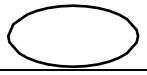
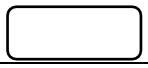
| | |
|---|---|
| | The instruction of the system action appears, indicating the following behavior and action of the child. |

| | |
|---|---|
| **Behavioral interaction** | The presence of scene transformation gives children the right to make independent choices. |
| | Give children body movements space to play; in the process of play, children can fully mobilize their body movements. |
| | Meet the characteristics of children's memory; the basic rules and plot settings of the game can be remembered in a short time. |
| | Rules of behavior during the game are practical, not abstract concepts. |
| **Sensory interaction** | During the game, the time information appears. And to be able to experience the passage of time in the game. |
| | Special effects for the concept of space experience; in the game, children can experience the object of space forever. |
| | For visual media design, the layout of game scenes differs from the social and natural environment. After feeling the simulated real experience, it can be distinguished from the actual situation. |
| | Experience of hearing; real and natural sound; non-electronic special effects. |
| | The touch experience is colorful, not-finger fingers. |
| | The critical content can be highlighted in the design and has a specific attraction to children. |
| | The training of language, join the training for children listening, speaking, reading and guidance. |
| **Emotional interaction** | The function of interaction and communication and sharing with friends. |
| | There is emotional communication in the game; you can interact with significant concepts in the game, such as expressions. |
| | The game scene development is naturally not abrupt, and the plot is coherent. |
| | The scene setting of the game conforms to the law of the natural development of life. |
| | Identify the right and wrong skills in the game's tone and guide the natural plot. |
| | Moderate difficulty; satisfying child self-actualization. |
| | Design of parent-child interaction; satisfy children's emotional interaction with parents. |
| | Whether games can evoke children's past experiences and deepen and strengthen past experiences. |

### 4.1 Analytic flow chart design

See the engineering design flow chart for expression. In this paper, the design of the flow chart as the main presentation form, the visual performance of children's video games in the process of interaction structure. The rectangle is used to represent the user's behavior. The rounded rectangle represents the user's thinking when using a video game product, and the diamond represents the behavior and judgment of the system. Arrows are mainly utilized as directional icons to indicate the direction of user actions and the flow direction of the game to analyze and intuitively show interactive design behaviors in children's video games. The specific representation is shown in Table 2.

Table 2. *Meanings of Icons in the Flow Chart*

| Interactive category | icon | Meaning in the flowchart |
|---|---|---|
| User action |  | The user's finger's basic direction of movement. |
| User action |  | The basic action of the user's wrist operation. |
| User behavior |  | Indicates the user's movement habits and thinking movements. |
| System behavior and judgment |  | Indicates response of the system to the user behavior. |
| Game start |  | Indicates the start of the game. |
| Game over |  | Indicates the end of the game. |
| Users think about action |  | Indicates user's thinking and judgment of behavior while using the product. |
| The game cycle |  | It indicates the game loop. |

### 4.2 Game Application case analysis

Select the most downloaded educational game as a filter. This study selected the Little Panda series from Apple Store, and more suitable for younger children. Therefore, this study will choose a game from this series as a case study. As shown in Table 3.

Table 3. *Game Information*

| Game Name | Baby Panda World |
|---|---|
| Game Introduction | Android developer *BabyBus* has been working on the platform since 2011. The two most significant apps on *BabyBus* are Baby Panda World and Baby Panda's Supermarket. Both apps are highly rated and have been downloaded more than 100 million times on Google Play. It has a wide range of options. You can take pleasure in managing your business and engaging with delicious food, or even succeed as a renowned fashion designer. |
| Game Storyline | Food, animals, careers, painting, and music are the five topics to research. Over 100 different interactive game categories include games like princess dress-up, graffiti, desert adventure, and underwater rescue. The game features linguistic hints, and each mini game has a plot that it corresponds to. There are no games with competition. |

| | |
|---|---|
| Game Method of Operation | Baby Panda World allows children to explore, learn and immerse themselves in various activities or tasks related to situations they might encounter in the real World. All games are based on engaging animations of baby pandas and their friends. Players can complete tasks in a highly visual and interactive manner. A clear verbal explanation of the required tasks is given at the beginning of each competition. Emphasizes listening skills and following instructions. Motion manipulation uses swiping or tapping on the phone screen. |
| Game Example | A small *train* game can be found in this game, for example. Children can first click on the screen to choose a locomotive and body. He was a train driver back then. The train started to whistle and move after pressing a button, traveling from station to station as shown on the map. A distinct mission will be assigned to each station. Examine the tickets of other passengers and keep track of their final destination while the train is still moving. |

According to table 2. The operation process of the case game *Train* is shown in Figure 4.

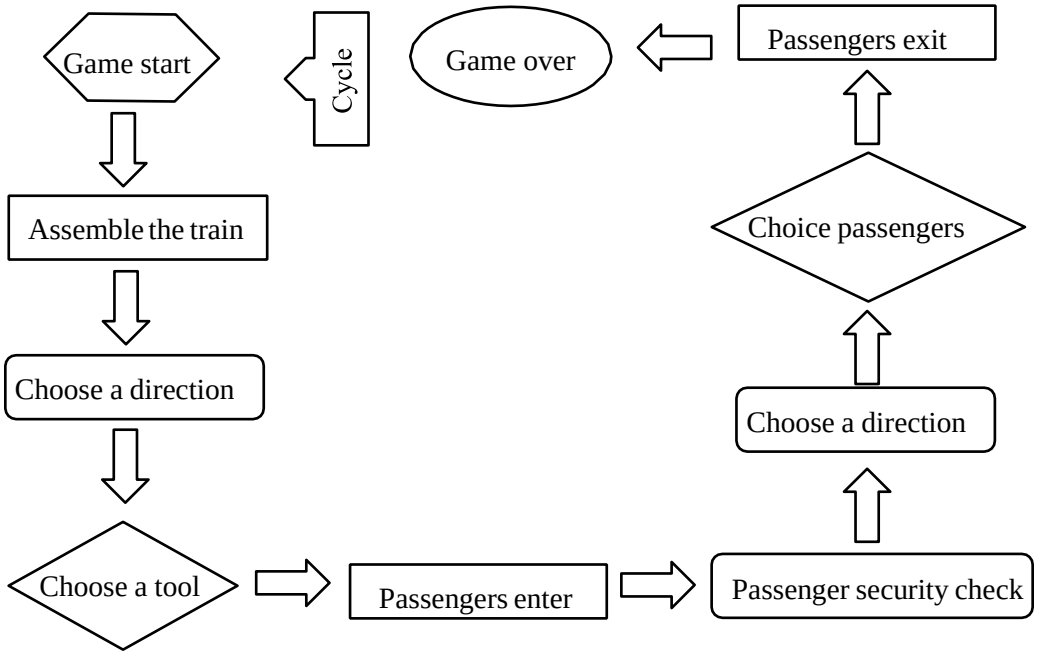



*Figure 4.* The flow of the game case

## 6. Conclusion

Computers have taken over visual, auditory, olfactory, tactile, and other signals in digital electronic products (Karray et al., 2008). However, most children's video games focus on reconstructing vision and hearing. For example, the incredible special effects of the *Baby Panda World* series bring visual and auditory impact experience to children. Marsh (2006) studies found that most three- to four-year-old children had established early digital literacy. Already the advent of the digital era is proving irresistible. Children must perceive the real natural world through personal touch (Beery & Jørgensen, 2018). For example, the tactile sensation of children touching the screen in a restaurant game is different from entering a real-life restaurant activity, and the taste of an authentic restaurant is not experienced. However, there is no denying that video games give children a whole new experience. Analysis of the problems with existing video game software for children reveals that most educational game applications overemphasize educational content and ignore children's cognitive development. It was found that most educational game applications designed for children overemphasize educational content and forget the cognitive developmental requirements of children. The actions are also limited, and the games are designed more to satisfy the market's needs than the children's developmental perspective.

User-centered gamification interaction strategy to improve the utilization of online education resources (Liu & Peng, 2013). Children interacting with intelligent characters, supporting healthy

lifestyles, learning skills, mobile, tangible and ubiquitous computing, and designing and evaluating technologies are among the focus of research in interactive design games for children (Hourcade, 2007). In the design of children's video games, the most important thing is not the game's look, the interface, or the special effects. Children should be allowed to experiment with body motions, especially in motion interaction design. In the process of play, children can fully activate their body movements. The critical core is the design of the interaction structure (Barab et al., 2005). Although a game directly touches the user with its interface, appearance, and special effects, the core of a video game is the interactive structure of the game. Whether the design of the interactive system in the interactive design of electronic games has the characteristics of humanization, conforms to the development of children in many aspects, rejects the addiction to electronic games, and includes more extensive interaction with real life in the process of playing. The multi-mode game experience is the future development trend and research direction.

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