Computer Play, Young Children and the Development of Higher Order Thinking: Exploring the possibilities.

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Abstract

The aim of this paper is to explore and review current understanding of the potential of computer play to enhance young children's cognitive development, as compared to the developmental value of traditional make-believe play in which children spontaneously engage during their early childhood years. Theories of play have identified many ways in which traditional play may advance children's cognitive, social and emotional development. Recently, much traditional childhood play is being replaced by time spent on computer play, and often from a very early age. To produce software that is appealing to young children, designers aim to present content in a play-oriented manner to attract and sustain children's attention. However, computer programs are often produced atheoretically for cosmetic appeal, using animations, colour, sound, and surprise as the basis of their design, rather than pedagogical principles or developmental theories of play. This research attempts to analyse the ways that knowledge of the developmental value of spontaneous play established in conventional play settings can be applied to the theoretical basis of computer play design for young children. Moreover, it is argued that computer play, if designed appropriately, might comprise some developmental potential which can go beyond that of traditional spontaneous play. In particular, it is hypothesized that the foundation for further development of higher order thinking skills such as complex systems of abstract, logic and sign-mediated operations and symbolic representation, can be established and reinforced by purposefully designed computer play.

Keywords

Computer games, child development, child's play, higher order thinking, abstract thought

1. INTRODUCTION

Whilst there has been an ongoing debate about the advantages and disadvantages of children's computer use (Alliance for Childhood, 2002), increased computer access for children in today's homes and childcare centres has become a reality. Over the past few years, a large amount of educational software has been produced to assist in the teaching and development of young children. Understanding the importance of play in early childhood years, software designers aim to present computer software for children in a playful way to make it more attractive and accessible to its young audience. Apart from commercial arcade games, produced for recreational play only, many different kinds of educational software have been presented in the form of play in order to attract and sustain children's attention to what otherwise might be quite a boring enterprise. However, the play component of children's software should not be seen as appropriate solely for recreational or fun purposes. Some authors urge instructional designers to seriously consider play and treat it as an essential part of the learning process (Rieber, Smith & Noah, 1998, p.7). They suggest that 'the time has come to apply what we know about learning, motivation, and working cooperatively given the incredible power and social connectivity of computers' (Rieber et al., 1998, p.2).

Over the past decade, there has been an increasing body of research that associates computer play with children's cognitive development, and in particular with the development of higher order cognitive processes (Amory, Naicker, Vincent, & Adams, 1999; Beavis, 2003; Betz, 1996; Pillay, 2003; Buchanan, 2003). What is surprising, though, is that this research mainly deals with the computer play of adults or high school students, but little has been done in regard to the developmental value of computer play for young children (Ko, 2003; Plowman & Stephen, 2005). There is still a significant gap in understanding the ways that children's spontaneous play can be related to computer games in order to enrich the developmental value of both.

2. SPONTANEOUS PLAY AND CHILDREN'S DEVELOPMENT

Early childhood educators know how important play is in children's lives. Play is not only an enjoyable and spontaneous activity of young children but it also contributes significantly to children's psychological development. A number of characteristics that distinguish play from other forms of human activity have been identified (Garvey, 1977). Play has been characterised as a spontaneous, self-initiated and self-regulated activity of young children, which is relatively risk free and not necessarily goal-oriented. Play is intrinsically motivated: normally children have an internal desire and interest to engage in play, they are actively involved in creating their play and are in control of it. An essential characteristic of children's play is the dimension of pretend—that is, an action and interaction in an imaginary, 'as if' situation, which usually contains some roles and rules and the symbolic use of objects (Leontiev, 1981; Nikolopolou, 1993).

The crucial role of play in children's development has been well documented in developmental psychology. Theories of play have identified many ways in which children's traditional play may advance their cognitive, social and emotional development (Verenikina et al., 2003). They are concerned with the ways that play benefits children's psychological development. While freely engaging in play, children acquire the foundations of self-reflection and abstract thinking, develop complex communication and metacommunication skills, learn to manage their emotions and explore the roles and rules of functioning in adult society. Theoretical approaches allow us to understand the significance that play has in the development of young children and the ways in which they are able to develop meaning through play. They have impacted teaching programs in early childhood settings, where play is located at the heart of the curriculum and used as a vehicle for nurturing children's development across its various domains (Van Hoorn, Nourot, Scales & Alward, 1999; Frost, Wortham & Reifel, 2005).

Focusing on the emotional development, psychoanalytic perspectives explain the value of play in allowing children to express and discharge negative emotions that relate to situations in which they have no control in their everyday lives (A. Freud, 1968; Erikson, 1963, in Verenikina et al., 2003). For example, undertaking the role of a doctor, children may relief their anxiety of staying in a hospital and gain a sense of control over the situation.

According to modern theories, play can significantly affect children's social development. The development of meta-communication is seen as an essential psychological characteristic which is influenced by children's play (Bateson, 1976, in Verenikina et al., 2003). It lays the foundations for the development of children's self-reflection in communication and the awareness of its rules and strategies. In play, children often are seen to take on the roles of others in their real lives—such as mother, father, baby, teacher and friend. Playing out such characters they observe and exercise different manners, ways of behaviour and styles of talking. Mead (1934, in Verenikina et al., 2003) viewed children's socio-dramatic role play as an important vehicle for developing their sense of self.

Piaget (1962) focused on the role of play in the development of children's cognition. Underpinning his views of how play contributes to children's cognitive development are two processes whereby children construct knowledge, assimilation and accommodation. Piaget maintained that it is assimilation that is dominant in play—children take something and make it fit to what they know, such as when a child makes rolled paper to be a royal sceptre. Piaget (with further adaptations from Smilansky,1968, in Verenikina et al, 2003) distinguished different kinds of play which have a different effect on children's development. These include: functional, constructive, dramatic or make-believe and games.

Talking about make-believe play, Piaget outlined the importance of this kind of play in the development of children's mental representation and abstract thinking. This idea was further developed in socio-cultural theories of play (Vygotsky,1978; Leontiev, 1981).

3. SOCIO-CULTURAL APPROACH TO CHILDREN'S PLAY

Socio-cultural theorists (Vygotsky, 1978; Leontiev, 1981; Nikolopolou, 1993; Bodrova & Leong, 1998) have drawn attention to the overarching role of play in child development and view it as the most developmentally influential activity of children which 'contains in a concentrated form, as in the focus of a magnifying glass, all developmental tendencies' of early childhood years (Vygotsky, 1978, p.74). In this context play is seen as a 'leading' activity of the early childhood years, that is, the leading source of development in preschool years. (Vygotsky, 1967, Bodrova & Leong, 1996; Leontiev, 1981). This means that the most significant psychological achievements of the early childhood age occur while children engage in play, and in particular, in its most advanced form such as make-believe play which is characterised by the presence of a 'situation of pretend'.

Vygotsky espoused the notion of the zone of proximal development—defined as the difference between a child's actual and potential levels of development (known, for example, by what a child can do alone and with the assistance of an expert other). According to Vygotsky (1978), play creates a broad zone of proximal

development, both in cognitive and socio-emotional development. This means that in make-believe, children are working above their ability in communication, deliberate behavior and self-regulation. In play, children also perform above their own cognitive abilities—logical thinking, memory and attention.

Vygotsky argued that make-believe play is socially and culturally determined. Playing the roles of real life characters such as a mother or a doctor, children achieve a mental representation of social roles and the rules of society. The toys, characters and stories utilised in children's play are seen to be significant artefacts from their social and cultural settings; thus, in play, children are acquiring the tools and meanings of their culture.

The most important influence of make believe play on children's development is the evolvement of mental representations and the separation of thought from concrete actions and real objects (Vygotsky, 1967). The pretend situation of play creates an imaginative dimension in which the child uses symbols and signs to substitute for objects and acts. For example, in actions such as riding a broomstick as if it were a horse, the child explores the notion of a horse in its symbolic way. Similarly, by pretending to be a mother, the child may explore and advance his or her understanding of the norms and rules of family functioning. 'Thought is separated from objects because a piece of wood begins to be a doll and a stick becomes a horse. Action according to rules begins to be determined by ideas, not by objects. This is such a reversal of the child's relationship to the real, immediate, concrete situation that it is hard to evaluate its full significance.' (Vygotsky, 1967, p.12).

In a situation of pretend, children separate the literal meaning of the object or situation from its imagined or symbolic meaning. Vygotsky (1967, 1978) stressed the role of symbolic play in the development of symbolic representation, such as symbolic function and symbolic action, which lays a foundation for further development of children's abstract thinking. The development of 'visual notions of reality and capacity to manipulate them, which are under formation at this age, constitute the ground floor of an entire building of human thinking. Without a basis like this, the construction and functioning of higher intellectual levels that are characterized by complex systems of abstract, logic, sign-mediated operations seem to be next to impossible' (Zaporozhets, 1986, p.242-243).

In spite of the strong argument that play is vital to the development of children's intellectual development, over the past few years there has been a concern that the push for early academics—such as teaching preschoolers to read and learn math and computer skills—is rapidly replacing imaginative play and experiential hands-on learning in young children's lives (Alliance for Childhood 2002; Elkind, 2001; Dau, 1999). 'The concern is based on the premise that without adequate opportunities for play, young children's development and learning will be seriously hampered' (Dau, 1999, p.5).

Under pressure to accelerate young children's learning, much educational software has been produced to assist in the teaching and development of young children. The majority of such software aims at supporting children's learning, and often at the level of basic literacy and numeracy skills. However, less is known about the ways that computer software can be used to support the natural (and essential for their development) ability of children to spontaneously engage in make-believe play. How can computer software be used to enhance and support children's play rather than replace it?

4. COMPUTERS AND CHILDREN'S PLAY

The current generation of children have been born into a computer environment; it has become a normal part of their everyday lives. Parents are happy to see their children exploring computers at a very early age as they become occupied with an activity that they really enjoy. Given the increased time and opportunities that children have for engaging with computers as they play, it is important to consider the implications this has for them. For example, Singer (in Alliance for Childhood, 2002) warns about the very limiting nature of the new generation of electronic toys such as talking and walking dolls as they don't leave enough room for children's imagination and creativity.

When assessing the quality of particular items of computer software for young children, researchers refer to its developmental appropriateness. NAEYC (1996) makes a statement that 'developmentally appropriate technology should be integrated into the regular learning environment and used as one of many options to support it'. The NAEYC statement (1996) summarises research that suggests that when working with developmentally appropriate software children tend to engage in a variety of social interaction such as joint problem solving, turn taking and cooperative play. However, computers should 'supplement and do not replace highly valued early childhood activities and materials, such as art, blocks, sand, water, books, exploration with writing materials, and dramatic play' (NAEYC, 1996).

For example, children might use computer paint programs to make signs for a restaurant or in their dramatic-play area (Apple Computer Inc., 1993, in NAEYC, 1996), and can thus see computer programs 'used in a meaningful context and for real purposes' (Siraj-Blatchford & Siraj-Blatchford, 2003, p.16).

Michael Cole describes a range of ways that computers may be incorporated into children's imaginative play (Cole, 1996). He elaborated on an after-school *New Information Technology and Literacy Program*, designed for five to twelve year olds and known as the 5th Dimension. The design of this program was guided by the cultural-historical psychological theory of Vygotsky. The project is structured around computers and telecommunications supported by specially selected software as well as making use of the Internet. The aim was to reinforce learning by including various computer software into the context of make-believe play and communication with peers and adults in a situation of pretend (Cole, 1996; Verenikina & Belyaeva, 1992).

However, due to the rapid development of technology and its fast growing market, there has been an increased amount of items of software produced for young children which are not designed to support children's natural play or any other of their traditional activities.

5. COMPUTER PLAY AND CHILDREN'S DEVELOPMENT.

There have been a number of studies that illustrated the advantages of using computers in early childhood education and play (Yelland , 2005; Flintoff, 2002; Cassell & Ryokai, 2001; Ko, 2002; Pillay, 2003).

Computer games can be useful in enhancing memory capacity, in concentration of attention and in the problem solving strategies of young children, which can indirectly affect their academic achievements (Flintoff, 2002). Cassell and Ryokai (2001) described a computer based environment, *StoryMat*, that can enhance developmentally advanced forms of children's collaborative storytelling.

Pillay (2003) explored the transfer of cognitive and meta-cognitive skills developed in recreational computer games to high school children's subsequent performance on computer-based educational tasks. The skills such as generating alternative solutions, information organisation and computer screen navigation were examined. The research demonstrated significant consistency of the mental skills used in educational computer games with those used in recreational games. Similar results were obtained in the research of Ko (2002) where the strategies of logical thinking used in recreational computer games were analysed.

Yelland (2005) provides an overview of numerous studies that examine the use of computers in early childhood education. Even though the early childhood curriculum is traditionally based in play (Van Hoorn et al., 1999), the majority of considered studies are focused on the use of computers to enhance learning in a particular curriculum area. It was demonstrated that the use of technologies can raise the level of early childhood curriculum so that 'young children can not only experience concepts that were previously well beyond that expected of them but that they could deploy sophisticated strategies and work collaboratively with others in new and dynamic ways in technological environments' (Yelland, 2005, p. 224). In particular, it was illustrated that computer software can provide advantages for teaching abstract mathematical concepts such as shapes which challenge the idea that the early childhood curriculum has to be predominantly based on the use of concrete materials. Research demonstrated pedagogical benefits in using the computer based manipulatives for advancing children's ability in abstract thought (Clements, 2000, in Yelland, 2005).

In regards to children's play it was concluded that 'the manipulation of symbols and images on the computer screen represents a new form of symbolic play, in which children treat the screen images as 'concretely' as they do the manipulation of any alternative blocks and small-world toys (Brooker, 2002, p. 269, in Yelalnd, 2005, p.221). This study indicates that there is a potential in further exploration of the affordances of computer play in the development of children's ability for higher order thinking.

6. CONCLUSION

Over the past few years, the amount of computer software targeted at young audiences, has significantly increased. To make it appropriate to the target age of children, such software is usually presented in a playful manner. It ranges from educational software, designed to enhance literacy and numeracy skills, to commercial arcade games, produced for recreational purposes only. To make the educational content of these software packages more attractive for children, it is often presented in a play oriented manner often equating play with fun, thereby diminishing the potential developmental value of such software in enhancing children's generic, higher order cognitive skills.

On the other hand, there is a significant underestimation of the potential developmental value of computer play designed for the purposes of children's recreation and entertainment. Educators still typically perceive computer games as a recreational or 'toy' technology only (Buchanan, 2003). This is not surprising, as children's spontaneous play sometimes, and traditionally, is seen as an activity which is opposite to work.

There is an need to further develop a theoretically-based set of criteria that will allow educators to assess individual items of computer software and judge on their developmental value when choosing particular products for their settings, or advising parents on the purchase of computer play packages for their children.

Given the time and opportunities that young children of today have for engaging with computers, it is important that software designers understand the richness of children's traditional play and utilize its developmental advantages in their products. It is also important to look into the features of children's play which can be supported and further enhanced by computer software. In addition, it is also essential that early childhood educators and parents are able to make an informed decision on the purchase of such products based on their educational or developmental value, rather than the often exaggerated claims of commercial advertising.

7. REFERENCES

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