

Educational toys: Learning to play or playing to learn?

Educational toys appeal to many parents, especially those hoping to promote their child's healthy development and encourage learning through play. The number and range of toys bearing the "educational" label are vast, and include: play-mats and fridge magnets intended to stimulate language skills; stuffed toys intended to cultivate number sense; interactive play tables designed to teach fine motor skills and bilingualism, and videos meant to stimulate a child's logic and reasoning skills. Though this niche toy market abounds with products, few manufacturers have offered up much in the way of evidence to back up their claims.

What does the evidence indicate about the educational value of toys bearing that designation?

Brainy toys

For decades, toy companies have marketed products with claims (direct and indirect) that they can help children develop language, math and problem-solving skills. For example, in 1974 a U.S. Office of Education review of research uncovered no evidence that such educational toys stimulate intellectual development or offer a particularly enriched environment.[1]

More recently marketers, keeping pace with the recent developments in brain research, have made claims that educational toys stimulate neural development.[2] Many parents are often swayed by such claims, believing that educational videos, television programs and computer games are an important part of a child's intellectual development. [3], [4] These parents report buying such educational toys despite admitting to being skeptical about the claims that the toys are based on research.[5]

There are multiple converging lines of scientific evidence showing that the human brain undergoes significant development in the early years.[6] The human brain grows four to five times larger between birth and adolescence as a result of the growth of connections (synapses) between neurons and of insulating material (myelin) that allows impulses to be rapidly conducted between neurons.[7], [8] This process is influenced by the child's environment and its learning opportunities.[9], [10] Neural growth is naturally followed by "synaptic pruning," a decrease of neural connections during development which is thought to be the result of learning experiences that create more efficient networks of brain activity.[11]

Since it is well-established that learning experiences influence the processes of brain growth and synaptic pruning, there is some factual basis for the claim that educational toys stimulate brain development. However, claims that the specific learning opportunities offered by educational toys are particularly valuable remain largely unsubstantiated.

Can toys be educational?

A few studies have revealed a relationship between playing with specific toys and the development of superior skills, but it's not clear that the toys actually contribute to those skills. For example, a 2001 study of kindergarten students showed that playing [Lightspan](#) video games (a series of curriculum-based games designed for the Sony Playstation in the late 1990s) is associated with higher spelling and reading performance among five- and six-year-olds.[12] However, since the children who participated in the study were required to play with peers and their parents for nearly seven hours a week for more than 11 weeks, it's unclear whether playing the game or playing with peers and parents contributed to the gains.

Building toys, such as model kits or Lego, demand a degree of visual-spatial ability and have been correlated with stronger spatial skills. But they have not been shown to be the cause of greater spatial ability in children.[13], [14] One explanation for this is that children who enjoy playing with toys that require strong visual-spatial skills likely have these skills already and are drawn to toys that match these skills.

DVDs and videos, such as the popular Baby Einstein series, offer learning experiences to young children yet research has shown that the learning that takes place is not equivalent to real-life experience. This is a phenomenon researchers have dubbed the *video deficit*.^[15] For example, researchers have shown that children aged 15 to 24 months learn new words faster and easier when interacting with an adult rather than watching television.^[16]

Infants are born with the ability to discriminate sounds in any language, but they lose their sensitivity to foreign language sounds over time as they begin to focus on the sounds of their own language. Some educational toys have capitalized on these findings, by presenting foreign words and speech to infants with the intent of preserving those early abilities. However, research has shown that providing infants with passive exposure to foreign sounds is not effective.^[17] For instance, infants from English-speaking households can learn to discriminate Mandarin sounds by interacting with a Mandarin-speaking adult but they cannot do so by watching and listening to Mandarin DVDs.^[18]

In sum, current research shows that while educational toys may possibly aid learning, they are not as effective as real-life learning experiences in which children interact with adults or other children. Further, some researchers have expressed concern that educational toys may actually hinder learning as they may discourage free play, restrict imaginative play and potentially replace real interactions with parents.^[19]

The evidence regarding any possible negative effects of educational toys is no stronger than the evidence showing beneficial effects. For example, studies have shown that children who watch television before the age of three are more likely to develop attention problems later in life.^[20] Yet, watching educational television programs at this age is not necessarily associated with later attentional problems.^[21] Meanwhile, poor language development has been associated with watching educational DVDs among very young children (8–16 months) but a causal relationship has not been established.^[22]

In other research, some educational shows (such as *Teletubbies*, *Barney and Friends*, *Sesame Street*) have been associated with poor vocabulary and expressive language in children aged 30 months; while other shows such as *Dora the Explorer*, *Blue's Clues*, *Arthur*) were shown to be associated with better outcomes. However this research did not control for pre-existing differences among children, so it is not clear if the content of the programs or other unrelated factors contributed to differences in language abilities.^[23]

The gap between research and the general public

While there have been significant advances in recent years about what we know of how the brain develops in childhood, such research findings are often misinterpreted, over-generalized or misapplied by the time they reach the general public. In science, the goal is to build incrementally upon existing knowledge to create an enduring body of knowledge that withstands the test of critical review. However, the popular media culture tends to seek out novel, unexpected information that appears practical and relevant.^[24] While this approach succeeds in capturing the public's attention, it too often neglects to report on the complexities and constraints of scientific research.

Over the last few decades popular media have seized upon findings from neuroscience and popularized messages that were not accurately based on the science. For example, between birth and age three, the human brain undergoes particularly rapid development.^[25] This finding has been misconstrued as indicating that the first three years of life form a now-or-never period of brain development during which critical learning experiences must be packed in.^[26]

Marketing for educational toys has seized on parents' desires to provide their children with the best possible environment, by presenting them with ideas that have roots in neuroscience, but take significant leaps in reasoning that are not necessarily warranted by the science. On one hand, there is a strong basis in scientific research to show that children require certain experiences (i.e., visual input, social interaction) to develop normally. There is also evidence to show that early experiences can contribute to a child's repertoire (i.e., proficiency in additional language).^[27] On the other hand, a strong body of evidence showing that extra experience in the form of "educational" toys will allow for extraordinary development simply does not exist.

Stretching the neuroscientific truth

A few years ago, researchers showed that experience could produce lasting neural effects on young owls. After wearing special goggles that shifted their vision to one side so that objects to the left appeared to be straight ahead, the owls' brains adapted and new neural connections formed to allow the owls to capture prey in the correct location. [28] After the goggles were removed, it was shown that the new neural connections remained and could be used by the owls in adulthood when the goggles were reintroduced.

This study was cited in media stories as supporting the idea that educational toys can stimulate new brain connections that can be used later on in adulthood. [29], [30] However, the study does not actually show that this finding is applicable to humans, that it applies to any educationally branded toys, that it applies to any of the numerous cognitive, sensory and motor skills in humans, or that these connections are useful beyond the specific context in which they were studied (i.e., shifted vision).

Lessons in Learning

Approach claims made about educational toys by manufacturers or media with caution

With or without evidence, the notion that educational toys are based on brain research and can provide important learning benefits is a persistent one. Parents should be conscious of the fact that there is little evidence to back up any claims made about the connection between educational toys and intellectual development.

Choose toys that encourage active exploration

Children are naturally motivated to explore their everyday environment. To encourage exploration, parents can provide their children with unstructured toys (i.e., balls, blocks, clay) that can be manipulated or assembled in a variety of different ways. Through play children construct ideas about how the world works, including cause and effect relationships.[31], [32] Research has shown that when toys present ambiguous cause-and-effect relationships children respond with greater exploration.

For example, in one study preschoolers were presented two different pop-up toys. With one toy it was clear how different levers served to pop up different dolls, while in the other toy the connection between the levers and the dolls was not as obvious. In the latter more ambiguous situation children spent more time exploring the toy, suggesting that they were more motivated to discover how the cause-and-effect situation worked.[33]

To encourage this type of exploration the focus should not be on the toy itself, but how the child interacts with the toy. Thus, a less-structured toy that can be explored and played with in a variety of different ways should be chosen over an "educational" toy that can only be manipulated in very specific ways. [Kathy Hirsh-Pasek](#), a well-known American developmental psychologist and author, recommends that "toys should not command the child, but that the child should command the toy." [34]

Choose toys that foster imagination and role-playing

In the second year of life most children begin to engage in symbolic play (i.e., "make-believe.") [35], [36] In this type of play, children use their imaginations to substitute one object for another such as a banana standing in for a phone. They also begin to role play, which includes such activities as acting out a story or fairy tale. Symbolic play has been associated with benefits in a variety of domains, including literacy, [37] creativity, [38] memory, [39] perspective taking [40] and self-regulation (managing impulses, emotions, thoughts and behaviours). [41]

In order to foster this type of play, toys should serve as props for the child's imagination, and generally more generic props allow for more imaginative uses. However, for younger children, props need to be more realistic to support make-believe play, whereas for older children, both realistic and abstract props will support make-believe. For example, it has been shown that three- to five-year-olds engage in more symbolic play with structured props (dolls,

dishes, cutlery) than with unstructured props like sticks, leaves and cardboard boxes). By age 5 or 6 children engage in sophisticated symbolic play with both structured and unstructured props.[42]

Choose toys that promote social interaction

Research has shown that playing with other children and adults has strong benefits for a child's development. It allows them to learn the skills to co-operate and engage in socially appropriate behaviour such as turn-taking and resisting the impulse to take a toy from another child, while giving them the skills needed to deal with their own negative emotions.[43] These self-regulatory skills are foundational, allowing children to make choices, engage in higher cognitive processes and prepare for the social requirements of school.

Thus, when selecting toys for their children, parents can choose to look for toys that are meant to be played with more than one child. Some educational toys promise interaction by having recorded messages that play when the child activates the toy, but these toys cannot serve as a substitute for the complex social interaction that occurs when sharing a toy with another child.

Interact with your child's use of TV, DVDs or video games

Research has shown that the best way for children to learn and develop new skills is through personal experience with another person.[44] For instance, when it comes to stimulating language learning rather than relying on toys that attempt to teach language, a child's development is much better served through interaction with a real adult who is speaking to and playing with the child in that language.[45]

The reality of today's media-infused environment is that children are likely to spend time playing video games and watching DVDs or television programs. When parents are present and interact with children while engaged with media content, children can learn much more effectively than when they are left to view them on their own.[46]

Conclusion

While there is a wealth of research showing that children's brains undergo a rapid period of development that is shaped by learning and experience, there is little in the way of actual research that shows that so-called educational toys can stimulate such development in children. There is substantial research highlighting the importance of free play and social interaction. Parents can focus on providing children with toys that allow for free play, imaginative use and social interaction.

[1] H. R. Quiltich, *How educational are educational toys?* Report from the Office of Education (Washington, D.C.: 1974).

[2] E. G. Jones & L. M. Mendell, "Assessing the decade of the brain", *Science*, 284, 739. Doi:10.1126/science.284.5415.739 (1999).

[3] Kaiser Family Foundation, *Zero to six: Electronic media in the lives of infants, toddlers, and preschoolers* (Washington, D.C.: Authors, 2003, Fall).

[4] DYG, Inc. *What grown-ups understand about child development: A national benchmark survey* (Danbury, CT: Authors, 2000)..

[5] K. Hirsh-Pasek, & R. Golinkoff, "Brains in a box: Do new age toys deliver on the promise?" In Harwood, R. (Ed.), *Child development in a changing society*, 1st ed. Hoboken (NJ: Wiley Press, 2008).

[6] M. H. Johnson, "Functional brain development in humans", *Nature Reviews Neuroscience*, 2, 475–483 (2001).

- [7] F. I. M. Craik & E. Bialystok, "Cognition through the lifespan: mechanisms of change", *Trends in Cognitive Science*, 10, 131-138. Doi:10.1016/j.tics.2006.01.007 (2006).
- [8] S. J. Webb., C. S. Monk & C. A. Nelson, "Mechanisms of postnatal neurobiological development: Implications for human development", *Developmental neuropsychology*, 19, (2001): 147-171.
- [9] M. S. C. Thomas & M. H. Johnson, "New advances in understanding sensitive periods in brain development", *Current Directions in Psychological Science*, 17 (2008): 1-5.
- [10] E. I. Knudsen, "Sensitive periods in the development of brain and behavior", *Journal of Cognitive Neuroscience*, 16 (2004): 1412-1425.
- [11] W. T. Greenough, J. E. Black & C. S. Wallace, "Experience and brain development", *Child Development*, 58 (1987): 539-559.
- [12] F.S. Din & J. Calao, "The effects of playing educational video games on kindergarten achievement", *Child Study Journal*, 31(2) (2001): 95-102.
- [13] L. A. Serbin & J. M. Connor, "Sex-typing of children's play preferences and patterns of cognitive performance", *The Journal of Genetic Psychology*, 134 (1979): 315-316.
- [14] D. M. Tracy, "Toys, spatial ability, and science and mathematics achievement: Are they related?", *Sex roles*, 17 (1987): 115-137.
- [15] D. R. Anderson & T. A. Pempek, "Television and very young children", *American Behavioral Scientist*, 48 (2005): 505-522.
- [16] M. Krcmar, B. Grela & K. Lin, "Can toddlers learn vocabulary from television? An experimental approach", *Media Psychology*, 10 (2007): 41-63.
- [17] L. R. Naigles & L. Mayeux, "Television as incidental language teacher". In D. G. Singer & J. L. Singer (Eds.), *Handbook of Children and the Media* (Thousand Oaks, CA: Sage, 2001), pp. 135-152.
- [18] P. K. Kuhl, F.-M. Tsao & H.-M. Liu, "Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning", *Proceedings of the National Academy of Sciences*, 100 (2003): 9096-9101. Available at www.pnas.org/cgi/doi/10.1073/pnas.1532872100.
- [19] P. Paul, *Parenting, Inc.* (New York: Times Books, 2008).
- [20] D.A. Christakis, F.J. Zimmerman, D.L. DiGiuseppe & C.A. McCarty, "Early television exposure and subsequent attentional problems in children", *Pediatrics*, 113(4) (2004): 708-713.
- [21] F. J. Zimmerman & D. A. Christakis, "Associations between content types of early media exposure and subsequent attentional problems", *Pediatrics*, 120 (2007): 986-992.
- [22] F. J. Zimmerman, D. A. Christakis & A. N. Meltzoff, "Associations between media viewing and language development in children under age 2 years", *The Journal of Pediatrics*, 151 (2007): 364-368. Doi: 10.1016/j.jpeds.2007.04.071

- [23] D. L. Linebarger & D. Walker, "Infants' and toddlers' television viewing and language outcomes", *American Behavioral Scientist*, 48 (2005): 624–645. Doi: 10.1177/0002764204271505
- [24] R. A. Thompson & C. A. Nelson, "Developmental science and the media: Early brain development", *American Psychologist*, 56 (2001): 5–15. Doi:10.1037//0003-066X.56.1.5
- [25] M. Barinaga, "A critical issue for the brain", *Science*, 288 (2000): 2116–2119.
- [26] J. Bruer, *The myth of the first three years: A new understanding of early brain development and lifelong learning* (New York: Free Press, 1999).
- [27] J. F. Werker & R. C. Tees, "Cross-language speech perception: Evidence for perceptual reorganization during the first year of life", *Infant Behavior and Development*, 25 (1984): 121–133.
- [28] B. A. Linkenhoker, C. G. von der Ohe & E. I. Knudsen, "Anatomical traces of juvenile learning in the auditory system of adult barn owls", *Nature Neuroscience*, 8 (2005): 93–98. Doi:10.1038/nn1367
- [29] L. de Vries, "[Baby toys have lasting effects: Owl study shows educational toys can help brain adapt later in life](#)", *CBS News* (2004, December 21).
- [30] "[Toys have lasting impact on brain](#)", *BBC News* (2004, December 23), Accessed December 2, 2009.
- [31] J. Piaget, *The child's conception of physical causality* (New York: Harcourt, Brace, 1930).
- [32] L. E. Schulz, A. Gopnik & C. Glymour, "Preschool children learn about causal structure from conditional interventions", *Developmental Science*, 10 (2007).
- [33] L. E. Schulz & E. B. Bonawitz, "Serious fun: Preschoolers engage in more exploratory play when evidence is confounded", *Developmental Psychology*, 43 (2007): 1045–1050.
- [34] P. M. Moretz, "Electronic educational toys not always the best gift, advise Temple and Delaware developmental psychologists", *Temple Times Online Edition* (2006, December 4), accessed December 2, 2009 from www.temple.edu/temple_times/december06/Xmastoy.html.
- [35] J. Piaget, *Play, dreams, and imitation in childhood*, (New York: Norton, 1945).
- [36] L. Vygotsky, "Play and its role in the mental development of the child", *Soviet Psychology*, 12 (1967): 62–76.
- [37] A. D. Pellegrini & L. Galda, "Ten years after: A reexamination of symbolic play and literacy research", *Reading Research Quarterly*, 28 (1993): 162–175.
- [38] J. L. Danksy, "Make-believe: A mediator of the relationship between play and associative fluency", *Child Development*, 51 (1980): 576–579.
- [39] L. S. Newman, "Intentional and unintentional memory in young children: Remembering vs. playing", *Journal of Experimental Child Psychology*, 50 (1990): 243–258.
- [40] S. M. Burns & C. J. Brainerd, "Effects of constructive and dramatic play on perspective taking in very young children", *Developmental Psychology*, 15 (1979): 512–521.

[41] L. E. Berk, T. D. Mann & A. T. Ogan, "Make-believe play: Wellspring for development of self-regulation". In D. Singer, R. M. Golinkoff, & K. Hirsh-Pasek (Eds.), *Play = Learning: How play motivates and enhances children's cognitive and social-emotional growth* (New York: Oxford University Press, 2006): 74–100.

[42] L. M. Umek & P. L. Musek, "Symbolic play: opportunities for cognitive and language development in preschool settings", *Early Years*, 21 (2001): 55–64.

[43] L. E. Berk, T. D. Mann & A. T. Ogan, "Make-believe play: Wellspring for development of self-regulation". In D. Singer, R. M. Golinkoff, & K. Hirsh-Pasek (Eds.), *Play = Learning: How play motivates and enhances children's cognitive and social-emotional growth* (New York: Oxford University Press, 2006): 74–100.

[44] D. R. Anderson & T. A. Pempek, "Television and very young children", *American Behavioral Scientist*, 48 (2005): 505–522.

[45] P. K. Kuhl, F.-M. Tsao & H.-M. Liu, "Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning", *Proceedings of the National Academy of Sciences*, 100 (2003): 9096–9101.

[46] S. Roseberry, K. Hirsh-Pasek, J. Parish-Morris & R. M. Golinkoff, "Live action: Can young children learn verbs from video?", *Child development*, 80 (2009): 1360–1375.