

Corporation for Public Broadcasting (CPB) (2002). Connected to the Future: A Report on Children's Internet Use. Retrieved January 9, 2006 from <http://www.cpb.org/stations/reports/connected>

- “65 percent of American children ages 2 – 17 now use the Internet from home, school or some other location” (this was in 2002)
- “83 percent of family households reported computer ownership – a 30 percent growth rate in two years.”
- “78 percent of children live in homes in which either they or a parent use the Internet from home, a 70 percent growth rate in two years”
- “Preschool children are one of the fastest growing groups to be online. Only 6 percent of children ages 2 – 5 used the Internet from any location in 2000; two years later, parents reported that 35 percent of the same age group now went online from some location.”
- “Online children ages 6 – 17 reported using the Internet on average 5.9 hours per week in 2002... Children ages 6 – 8 reported spending 2.7 hours per week online”
- “Children's online activities are diverse, with an emphasis on exploration (surfing and searching), communication (instant messaging, emailing, chat rooms), and entertainment (playing games, downloading and exchanging music, pictures and videos). Learning – both informal and formal – is also an important part of the digital mix for children.”
- “Children ages 6 – 17 who are online at home ranked educational activities (such as homework, research projects, and learning not related to schoolwork) among their top five everyday uses”
- Children 6 – 8 spend 2.7 hours a day with TV and 1.9 with digital media, ages 9 – 12 3.3 and 2.7, ages 13 – 17 3.1 and 3.5. The amount of time that kids are spending in front of the TV is being caught up by computers.
- “(the internet's) role as a research tool is evolving more quickly than as a curriculum tool.”
- “Parents are happy with their children's online activity (83 percent), 81 percent said that the educational value of the Internet and its propensity to encourage exploration were the main reasons parents cited for the pleasure they take”

Hutchinson, A., Bederson, B., Druin, A. Interface Design for Children's Searching and Browsing. Retrieved December 20, 2005 from <ftp://ftp.cs.umd.edu/pub/hcil/Reports-Abstracts-Bibliography/2005-24html/2005-24.htm>

- “one major challenge for designing information technologies for small children is understanding the design requirements of interfaces and interaction modalities to suit their limited reading abilities and motor skills.”
- “the constraints of current technologies and the cost limitations involved when designing products for the school environment”
- “Children communicate and learn through play and exploration. Through social interaction and imitating one another”
- “Research shows that the use of computers can foster social support and interaction.”

- “Observational experiments on the user of computers in rural India suggest that children were able to, without previous instruction, reach a basic level of computer literacy.”
- “Most educational media for children do not support social aspects of learning such as context and culture”
- “As a general rule, children’s systems are based on adults’ products which are not suited to young user’s skills and requirements.”
- “Few examples in the market can be found of interactive educational products designed for collaboration or that address the relationship between form and interactive collaborative play.”
- “User studies revealed problems the children experienced when interacting with computers and suggested that the traditional PC stations used were not suited for children’s physical and cognitive ergonomic requirements... the display was generally placed above their line of sight... the desk diminished the child’s freedom of movement”
- “Explored the concept of tangible interfaces, by using the natural affordances of toys and children’s artifacts in the creation of digitally augmented objects” (globes, trading cards, hand puppet, pencils...)
- “Teachers believe that a combination of interactive visuals, sound and text could be a powerful resource to support the curriculum”
- “analysis suggests that the children considered the input tools to be fun to use and that the cards seemed to offer clear affordances”
- Prototyping for children puts great demands on the implementation of prototypes. Conveying realistic experiences required a high level of detail in the implementation of the content, hardware and user interface.

Africano, D., Berg, S., Lindbergh, K., Lundholm, P., Nilbrink, F., Persson, A. Designing Tangible Interfaces for Children’s Collaboration. Proceedings of CHI 04 (Vienna, Austria, April 2004), ACM, 1-58113-703-6/04/0004.

- “elementary aged children are among the largest user groups of computers and the Internet.”
- “Children are capable of doing Boolean searches, but have difficulty with the sequential presentation of hierarchical structures”
- “One of the largest groups of computer and Internet users is elementary-age children. In 2002, 83% of US homes with children owned a computer and 78% accessed the Internet. In 2003, 42% of US children age 5 – 9 and 67% of children age 10 – 13 used the Internet.”
- “(Current interfaces and web sites), do not take into account the information processing and motor skills of children, specifically their difficulties selecting small objects with a mouse. Second they do not consider children’s searching and browsing skills, specifically their difficulties with spelling, typing, navigating and composing queries. Third they do not consider how children prefer to search, presenting search criteria appropriate for adults, but not for children.”
- “large easily clickable icons, rather than keyword search box” allowed children to easily find information and worked with their limitations (QueryKids website)

- “young children process information more slowly than adults, and this affects their motor skills, children are slower to acquire a target than adults and require larger targets. Children have difficulty holding down a mouse button for extended periods of time, coordinating dragging and clicking, double-clicking and using multi-button mice.
- “Keyword searches are problematic because children have difficulty spelling, typing and composing queries.”
- “Early elementary children choose books based on the appearance of the cover and illustrations”
- “First task was a free browsing task to observe how participants used an interface without instruction. After the children explored for two or three minutes, the researcher demonstrated the interface.
- “Navigation tools must be large and prominent... large conspicuously placed navigation arrow... presentation may be too small and/or get lost among other buttons”

Regan, A., Grahn, J., Jonsen, J. Interactive Educational Tool for Dyslexic Children. Retrieved January 10, 2005 from <http://www.dh.umu.se/default.asp?sida=351>

- “Approximately 5 – 8% of all children have dyslexia”
- “through playing and having fun, stimulates the interest to learn reading and writing”
- “Storytelling is used to create interest and stimulate curiosity to learn more and move forward in the program.”
- “An educational tool that is not based upon competition, but the child’s own curiosity, and from that creates a desire to learn.”

Sullivan, T., Norris, C., Peet, M., Soloway, E. When Kids Use the Web: A Naturalistic Comparison of Children’s Navigation Behavior and Subjective Preferences on Two WWW Sites. Proceedings of 6th Conference on Human Factors & the Web (Austin, TX, June 2000).

- “United States alone spent \$675 million in 1997 – 1999 on telecommunications-related services for school children in grades K – 12.”
- “To date general research on Web usability has focused primarily on adults, with little extant Web usability research focusing on the potentially unique needs of children”
- “Disney uses several different terms in referring to an admission pass to their various amusement parks.” This was confusing for children while using the site.
- “Most children routinely wait for the images on a page to load prior to navigating off that page”
- “Banner blindness – selective inattention to the region on the screen that is most commonly used to display banner advertising”
- “About half of our subjects persisted in following a known unproductive path three or more times prior to abandoning it” They follow their own usage patterns

Siek, K., Rogers, Y., Connelly, K. Fat Finger Worries: How Older and Younger Users Physically Interact with PDAs. Proceedings of Interact 2005, LNCS 3585, p.267-280.

- “There is a need to consider age-related abilities such as vision, dexterity, coordination, and cognition.”
- “Older people could read faster with a larger, more legible 14-point san serif font on web sites”
- “all users performed better when sound was added” in a study that tested basic mouse tasks
- “Older people make more mistakes than adults and had the most difficulty with fine motor control tasks such as double clicking... were slower because of the reduced fine motor control, muscle strength, and pincher strength associated with older age.”
- “Studies suggest that there may be performance differences for older people when using small handheld devices. They may find it hard to manipulate small buttons that are close to one another and read small icons on a screen”
- Current PDA icons are 7.76mm. The task concluded that older participants preferred larger icons approximately 20mm.

Inkpen, K., Booth, K. S., and Klawe, M. Interaction Styles for Educational Computer Environments: A Comparison of Drag-and-Drop vs. Point-and-Click. Technical Report (1996), 96-17. Department of Computer Science, University of British Columbia.

- “Children have more difficulty operating a drag-and-drop type of interaction than a point-and-click interface.”
- “The software and hardware that children encounter is for the most part modeled after systems originally designed for the business community.”
- “Difficulty performing a drag operation over long distances in the Macintosh version. Difficult to maintain pressure on the mouse.” Would this be different for PDAs since the screen is very small and they would be using their finger or a stylus?
- “Children indeed will adapt to whatever interface they are presented with, but in a school environment it is important to have the computer be a useful, effective resource for children.”

Myers, B., Nichols, J., Wobbrock, J., and Miller, R. Taking Handheld Devices to the Next level. Comm. IEEE, 2004, pp. 36 – 43.

- “The smart homes of the future will have ubiquitous embedded computation, and an increasing number of appliances can already communicate wirelessly”
- “Handheld devices, such as personal digital assistant (PDA) or cell phone, could serve as a simpler, more effective remote control.”
- “PDAs can assist in providing both appliance and computer access for the disabled, including the development of new text entry methods for the motor-impaired user.”
- “Many instructors frequently stop their class to ask the question... instructor could easily keep track of who is answering and get a bar graph of the results.”

Stanton, D., Bayon, B., Abnett, C., Cobb, S and O'Malley, C. In Proceedings of Human Factors in Computing Systems (CHI 2002) ACM Press. P.820.

- “A larger visual display in which (children) could input content (using PDA).”
- “There fore it was crucial to incorporate instant feedback when an item was being used so children were always aware of the effect of their action. Each device could be used individually as well as collaboratively.”

K12 Handhelds: Handhelds in Education Case Studies. Retrieved December 13, 2005 from <http://www.k12handhelds.com/casestudy>

- “The educators pioneered an innovative program to integrate handhelds seamlessly into all areas of the curriculum and foster increased student organization.”
- “although small in size, a handheld is a powerful learning device, that can help the student become a better reviewer, note-taker, writer, mathematician, and all-around organized individual.”

Soloway, E. Supporting Science Inquiry in K – 12 Using Palm Computers: A Palm Manifesto. Retrieved December 13, 2005 from <http://www.pdaed.com/features/palmmanifesto.xml>

- “a Palm computer can be used for 15 minutes, put back in the desk, hauled out in the afternoon for further work, and finally can be used at home in the evening to further review and refine a student's artifact.”
- “Laptops and desktops simple do not support such direct and immediate collaboration (beaming).”
- “Palms support teachers evaluating students' progress... a teacher can quickly review what each child has accomplished that day... moreover a child can easily show his / her parents what they did in school that day.”

Chang, Y., Mullen, L., and Stuve, M. Are PDAs Pedagogically Feasible for Young Children?. Featured in The Journal Online: Technological Horizons in Education (March 2005)

- “Teachers should consider the physiological and cognitive rediness of the device in relation to the learner.”
- “PDAs hold promise as a solution to the problem of providing computing opportunities because of their lower cost.”
- “Increasing numbers of K – 12 educators are exploring the role of handhelds as an instructional tool.”
- Other factors such as student motivation to complete school work and on-task behaviors also increase with the use of PDAs”
- “More than 90% of the teachers in this study reported that handhelds are an effective instructional tool which contributed positively to student learning.”
- “A major concern regarding handhelds for younger children focuses on their lack of motor coordination.”

- “Three of the four children responded that they would push, or touch, the icons with the stylus, all of the four children associated the icons with the stylus.”
- “All four children held the stylus like a pencil”
- “The children understood the nature of reversibility – maneuvering from the home screen back to another program.”
- “which makes PDA operating systems more age-appropriate in terms of maintaining focus on task.” (not having to multi-task and navigate like a browser or like having multiple screens open at once.
- “Two children correctly assessed that the button with a house icon would take them back to the original screen.”
- “The children all manages a small space in the Note Pad program very well in order to fit their names or draw pictures.”
- “The operating system of a PDA, which requires simpler steps in overall manipulation than a desktop computer, also may be more suitable for young children.”
- “The PDA should allow them to be in control”
- “Children also quickly grasped the function of icons and keys in PDAs as they observed the adult’s actions and tried to apply those actions on their own.”
- One teacher was “Interested in the area of literacy as an added dimension to writing. She wanted to see a letter identification game.... She felt that a PDA could facilitate fine motor control development.”
- “PDA when it can be taken home by children and used as a tool for collaboration and communication between home and school.”

Burke, G. PDAs going to school: Students like adapting new technologies for classrooms. Mercury News Online (December 12, 2005). Retrieved December 13, 2005 from <https://www.mercurynews.com/mld/mercurynews/business/13388023>

- “Engage students already accustomed to instant messaging and interactive video games, they’re buying up the kind of tech tools once reserved for jet-setting corporate executives.”
- “28 percent of US school districts offered handhelds for students and teacher use.”
- “Electronic learning has become so popular that one school in Arizona went textbook free this year, instead equipping its students with laptops. 17 schools outside Eugene, OR, now use handhelds on most science field trips.”
- “Nine year old routinely beam in their homework”
- “Using a drawing and graphics application called TealPaint, students can animate their versions of Aesop’s tales to transform a fable into a digital flipbook.... Quizzler gives students instant feedback on multiple choice tests.”

Demming, G. Children are users too. Retrieved December 13, 2005 from ukupa.org.uk/presentations/Children_UCD_15-03-04.pdf

- “Children are not young adults, but a special user group”

- “Simplification is the key”
- “Different age groups within ‘children’ will have different consequences in terms of data collection and affect: Their ability to verbalize and write at different ages will affect study design. Their ability to concentrate. Their propensity to please or disrupt.”
- “Do not underestimate how technically savvy children are.”
- “Children work best in their natural environments”
- “Explain the technology used for testing and make it as non intrusive as possible”

Papert, S. Child Psychologist Jean Piaget: He found the secrets of human learning and knowledge hidden behind the cute and seemingly illogical notions of children. Time Reports (March 29, 1999) Retrieved December 14, 2005 from http://www.time.com/time/classroom/psych/unit1_article1.html

- “Children don’t think like grownups”
- “Children are not empty vessels to be filled with knowledge, but active builders of knowledge – little scientists who are constantly creating and testing their own theories of the world.”
- “Children’s primitive laws of physics: that things disappear when they are out of sight; that the moon and the sun follow you around.”

Cernuzzi, L., and Sanchez, J. Web Site Interaction Design for Children with Disabilities. Proceedings of CSUN 98 (February 16, 1998).

- “sensory or learning disabilities it is important to explore methods that maximize communication and interaction efficiency while attempting to overcome the barriers of a specific impairment”
- “Particular care must be taken to avoid interfaces that demand too high cognitive and interaction abilities.”
- “providing accessibility means removing barriers that prevent people with disabilities from participating in substantial life activities”
- “the browser must be able to present the information in different formats required by different users, and be usable by individuals with a wide range of skills and abilities”
- “web sites often use fixed modality, assuming that a user is normally sighted and can use upper limbs”
- “Speech hearing and motor impairment → images, video, text instead of audio, graphics. Visual impairment → sound instead of textual and visual, Braille display. Language impairment → sound instead of textual, video to represent visual ideas, symbolic graphics.”
- “Selecting text links can be difficult because of the small target area and dexterity needed to select them with a mouse pointer. Often pictures or graphics make it easier to navigate and comprehend a site.
- “avoid interfaces that demand too high of a cognitive load”

Perdrix, F., Gronnolers, T., Lores, J., and Gonzalez, M. Studying the Usability of a web site focused on children. HCI International 2003, Creta, June 2003

- “great difference between the mental model of the developer and the end user”
- “Most users prefer to learn software by exploration and in addition it should be mentioned that in childhood the active multimedia environments favour exploration and make learning more stimulating, attractive and amusing.
- “Infant education (between 3 and 6 years old), the initial cycle of primary education (between 7 and 10 years old) and the superior cycle of primary education (more than 10 years old)”
- “Reading difficulty is an important problem, and in this sense it was also observed that the vocabulary used was too complex for children”
- “children don’t like to read things that they are going to directly play” they like to interact, even if reading is not a problem for them.

Naidu, S. Evaluating the Usability of Educational Websites for Children. Usability news (7.2, 2005) Retrieved on December 14, 2005 from

http://psychology.wichita.edu/surl/usabilitynews/72/children_internet.htm

- “approximately 75% of children who used the Internet in 2002 went online at their school, an increase of about 12% from 2000.”
- “while children preferred an interactive website, too many frames caused confusion and tables with elaborate listings and poorly organized links were cognitively demanding”
- “Searching by keywords often resulted in failure because of misspellings or inappropriate search terms.”
- “finding contact information proved to be extremely difficult.... Primarily because this information was located at the very bottom of the page”
- “overwhelming number of link choices on this site and terminology that did not match what the participants’ were thinking.”
- “Participants using FactMonster.com were more positive about the colours than the other sites.”
- “Children, in general, tend to be positive about a website even when they do not perform well.”
- “children, tended not to scroll down the page even when reminded”
- “terminology: having multiple terms for the same thing, or using terms that are not familiar to students”
- “The younger children liked the larger font size and pictures”
- “many children inadvertently clicked on advertisements and ended up on a completely different page.”

Kid size examines the trends and traditions of adults designing for children. Carnegie Museum of Art: News Release. Retrieved on December 14, 2004 from

<http://www.cmoa.org/info/npress68.asp>

- “Six themes based on specific childhood needs; play, mobility, patterns of sleep, basic functions, learning, and seating.”

- “designs that stimulate creativity, improve motor skills, educate and entertain”
- “planned lessons and structured classroom setting called for rows of functional and non-distracting desks and chairs”

Nielsen, J., Kids’ Corner: Website Usability for Children. Alertbox, April 14, 2002. Retrieved on December 13, 2005 from <http://www.useit.com/alertbox/20020414.html>

- “Kids tend to use ads as content, and click accordingly”
- “Even though participants in our study were very young, they often had the greatest success using websites intended for adults. Sites such as Amazon and Yahoo are committed to utter simplicity”
- “Our study found that children are incapable of overcoming many usability problems”
- “Make it go faster! Maybe if I click it, it will go fast...”
- Unclear navigation confirmation of the users location
- Inconsistent navigation options
- Non-standard interaction techniques caused problems
- Lack of perceived click ability
- Fancy wording
- “animation and sound effects were positive design elements for children; they often created a good first impression that encouraged users to stay with a site”
- “Children were willing to “mine-sweep,” scrubbing the screen with the mouse either to find clickable areas or simply to enjoy the sound effects that different screen elements played”
- “Geographic navigation metaphors worked, pictures of rooms, 3D maps”
- “Children want content that is entertaining, funny, colourful, and uses multimedia effects. However, the user interface should be unobtrusive and let kids get to the content as simply as possible”

Bernard, M. Criteria for optimal web design (designing for usability). Software Usability Research laboratory. Retrieved on December 13, 2005 from <http://psychology.wichita.edu/optimalweb/children.htm>

- “Websites should try to be playful and exploit their general curiosity by making the site’s content attention-grabbing and challenging”
- “pages that can be printed out”
- “Found that children often click visible features on a screen just to see what would happen. If there is a resulting animation or sound, children would often repeatedly click that area of the screen just to continue the animation or sound”
- “Children tended to wait for images to completely load on a page before navigation to another in the belief that a complete loading was mandatory”
- “Children may find it easier to recognize actual pictures of objects than to use symbols to represent them. Icons should reflect this by being as concrete as possible.” Not business related, size of a quarter, roll over state

- “Children are typically unfamiliar with many business-related concepts, such as file folder. Eg using “oops” instead of an undo button”
- “Fourth and fifth graders significantly prefer the 14 point Arial and 12 point comic sans font, over 12 point times new roman font.

Hanna, Ridsen, and Alexander. Guidelines for Usability Testing with Children. Interactions (September-October 1997), 9 – 14.

- “visit homes and schools to gather observational, interview and questionnaire data on children’s use and likings of computer products”
- “three common target age ranges, 2 – 5, 6 – 10, 11 – 14”
- “2 – 5 children should be allowed to explore the computer according to their own interests and pacing instead of performing a series of directed tasks”
- “Observe children’s behavior such as sighing, smiling or sliding under the table”
- “make the lab child friendly”
- “place microphones close to the children”
- “establish a relationship”
- “make sure they have at least some experience”
- “switch the order of tasks so children aren’t always tired at the end task”

Larkin, S. Usability, Jr. – How to Run a Successful Usability Test with Children. STC Usability SIG Newsletter (January 2002)(Vol 8, No. 3)

- Be careful about recruitment
- Use age-appropriate terms
- Consider options for user feedback
- Take into consideration the attention span of young children
- Think about what children might not know
- Explain the purpose of the testing
- Children tend to suggest what they really would like to see, regardless of feasibility
- Children understand usability