The Impact of *Cyberchase* on Children's Mathematical Problem Solving

Cyberchase Season 2 Summative Study
Executive Summary

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July, 2003

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Purpose and Design

To assess the impact of *Cyberchase* on children's mathematical problem solving, MediaKidz Research & Consulting conducted summative research using an experimental/control, pretest/posttest design. Participants were 108 third- and fourth-grade children (53 girls and 55 boys) at an ethnically diverse school in Pelham, NY.

Approximately one-half of the children were designated as "viewers" and the other one-half as "nonviewers." Over a four-week period, viewers watched 20 episodes of *Cyberchase*, one episode per day, while nonviewers watched 20 episodes of a PBS series about American history. Each episode of *Cyberchase* dealt with a different mathematical topic that pertained to one of two overarching clusters: measurement or organizing data. Teachers were instructed not to incorporate the episodes into their lessons, and not to comment or expand upon them in any way. Thus, the viewers' exposure to *Cyberchase* consisted of sustained, unaided viewing.

Learning was assessed on three levels:

1) *Direct learning* from four specific episodes of *Cyberchase*, as reflected in children's ability to replicate solutions to problems that viewers had seen in a given episode;

2) *Near transfer* – that is, children's ability to apply the same mathematical principles to new problems that were similar to the ones seen in *Cyberchase*; and

3) *Far transfer* – children's ability to apply similar mathematical problem-solving strategies to novel problems that were less similar to the ones seen in *Cyberchase*.

Direct learning and near transfer were assessed via paper-and-pencil problem-solving tasks, which were administered on the same day that viewers watched the relevant episode. Far transfer was assessed via one-on-one, task-based interviews in which children worked on several hands-on problem-solving tasks. Two pretest tasks were presented before the four-week viewing period, and four posttest tasks (two of which were mathematically identical to the pretest tasks) were presented two to three weeks after the end of the viewing period.

To avoid any possible experimenter bias, all of the learning measures were administered and coded by researchers who were blind as to whether the children were viewers or nonviewers.[1]

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[1] Several children referred explicitly to *Cyberchase* in the posttest, so researchers knew that these children had seen the series. However, since the children also could have seen *Cyberchase* on broadcast television at home, the researchers still could not be certain whether they were part of the "viewer" or "nonviewer" group in the study.

Results

Overall, the results of the study indicate that children learned from *Cyberchase* and enjoyed watching it. As one might expect – and in keeping with past research in the field of education – the strongest and most consistent effects were found in measures that were closest to the *Cyberchase* programs (in both content and time). Thus, the strongest effects were found in measures of direct learning, followed in turn by near transfer and far transfer. Indeed, far transfer represented the strictest test of the effects of the series, because: (a) the posttest problems were administered two to three weeks after viewing and (b) the problems were "dressed" in different surface contexts than the problems seen in *Cyberchase*. Thus, it makes sense that effects would be less powerful/consistent in the far transfer tasks -- and it is encouraging that some significant effects appeared at all.

Some highlights of the results were:

- Viewers outperformed nonviewers on all four measures of direct learning (i.e., in which children solved the same problem that viewers saw that day on *Cyberchase*). That is, viewers' solutions to the problems were mathematically more sophisticated than nonviewers', suggesting that viewers had learned the material presented on television. All of these differences were statistically significant.

- Viewers also produced more sophisticated solutions than nonviewers in all four measures of near transfer (i.e., in which the problem was similar to the one in that day's episode, but the answer was different). However, only some of the differences between viewers and nonviewers were large enough to be statistically significant; the difference was significant in the two problems that concerned organizing data, but not in the two problems about measurement.

- Children received two scores for each of the far transfer tasks presented in the interviews. One score reflected the number of problem-solving heuristics a child had used (e.g., looking for patterns, making a list) and the other reflected the sophistication of his or her solution. Viewers outperformed nonviewers on some, but not all, of the interview measures. Specifically:

  ➢ Viewers' solutions to a posttest problem involving a Venn diagram were significantly more sophisticated than nonviewers'. While working on this problem, viewers also applied more heuristics than nonviewers; however, the difference was not large enough to be statistically significant. These differences were attributable to significantly greater numbers of viewers employing two key heuristics: (1) changing the hands-on materials by rearranging two separate loops to form a Venn diagram and (2) explicitly recalling information (primarily information from *Cyberchase*).

➤ From pretest to posttest, viewers showed significantly greater growth than nonviewers in the number of heuristics they used while working on combinatorics problems. A similar pattern of data was found for children's solutions to the problem, but the trend was not strong enough to be statistically significant.

➤ No significant differences were found in either the number of heuristics used or the sophistication of children's solutions to a posttest problem involving the perimeter and area of regular shapes.

➤ However, from pretest to posttest, viewers showed marginally greater growth than nonviewers in the number of heuristics they used while solving problems involving the area of irregular shapes. A similar pattern of data was found for children's solutions to the problem, but the trend was not strong enough to be statistically significant. These differences primarily reflect the fact that viewers were: (1) marginally more likely to use nonstandard forms of measurement (i.e., other than a ruler), (2) significantly more likely to keep track of their work by writing down measurements or equations, and (3) significantly more likely to transform the problem (i.e., simplify it by eliminating the irregular parts of the figure).

- In the vast majority of cases, the effects of *Cyberchase* held true for both boys and girls, as well as children of different ages, ethnicities, and levels of ability in mathematics. Of the 48 statistical analyses that tested for effects of these demographic variables, 41 found no interaction between these variables and the effects of *Cyberchase* (even in cases where, e.g., older children received higher scores overall).

- The appeal of *Cyberchase* was strong. At the end of each week of viewing, viewers rated the series' appeal on a five-point scale ("Great-Good-OK-Not So Good-Terrible"). In all four weeks, *Cyberchase* received mean appeal ratings between "Good" and "Great." Every episode was chosen as a favorite by at least one child; overall, the children's favorite episode was *Totally Rad* (show #202), followed by *Of All the Luck* (show #112).