

Cyberchase: The Next Frontier

Analysis of Web Analytics



Shalom Fisch
Shina Aladé

Research conducted for Thirteen/WNET
Revised draft: June 28, 2012

MediaKidz Research & Consulting

Educational Consulting • Research • Writing

78 Grayson Pl., Teaneck, NJ 07666

Ph/Fax: (201) 833-9415 E-mail: medlakidz@lycos.com

EXECUTIVE SUMMARY

To evaluate the success of the *Next Frontier* redesign in increasing traffic to the *Cyberchase* Web site residing on PBSkids.org, as well as in facilitating searches for desired mathematics content and encouraging users to engage in multiple activities that deal with related math content, we analyzed Google Analytics data covering the first two months of the *Next Frontier*, from its launch on October 24, 2011 through December 24, 2011.

Results of the analysis included the following:

- In only two months, the redesigned *Cyberchase* Web site attracted more than four million visits, from more than 2.5 million unique visitors (i.e. not counting multiple visits by the same user). This represented more than twice as many visitors and nearly twice as many visits as in the previous two months of 2011.
- Increases were also found in the percentage of new users (i.e. users who had not visited previously during the two months studied) who visited the site. However, the average number of pageviews and time spent decreased after the launch of *The Next Frontier*, which can probably be attributed to its streamlined navigation (which requires fewer steps to reach a given page) and to users who entered the site through search engines or other external links and left soon after.
- Menus continued to be the most popular means of navigation within the site. However, Learning Pathways were used more than 75,000 times to navigate directly from one activity to another. In more than 60,000 of these instances, users chose to follow one activity with another that addressed related math content, thus reinforcing learning.
- The new Find-It page, which allows users to search by mathematical topic, was used nearly one half-million times, and by more than 300,000 unique users. Users most often searched for material related to fractions, although this may have been inflated somewhat by the position of the “fractions” button at the top of the Find-It menu.
- Thus, the present data suggest that *The Next Frontier* succeeded in achieving its goals of increasing traffic to the *Cyberchase* Web site, making it easier for users to find material addressing a given math topic, and reinforcing learning by encouraging users to engage in multiple activities regarding related math content. In-person research would be needed to document the impact of this engagement on children’s learning, but past summative research has already shown that use of *Cyberchase* media contributes to significant increases in children’s mathematical problem solving.

INTRODUCTION

Cyberchase: The Next Frontier is a redesign of the *Cyberchase* Web site that resides on PBSkids.org, designed to increase traffic to this informal mathematics education site and support learning by encouraging users to engage in multiple activities – spanning a variety of media (videos, online games, hands-on activities) – that involve related mathematics content. To that end, in addition to redesigns of the *Cyberchase* homepage and other areas of the site, prominent aspects of the *Next Frontier* redesign include:

- *Learning Pathways*: Each of the site’s games, videos, and hands-on activities is now accompanied by a menu of three Learning Pathway options that allow a user to navigate directly to a related activity after they try the current one. Three Learning Pathway links appear on each page, under the heading of “More Cool Stuff.” One Learning Pathway links to an activity that deals with similar mathematics content (thus reinforcing learning), one to an activity that features the same character, and the third is a “surprise me” option in which the user does not know what the next activity will be.
- *Find-It*: The Find-It page allows users to search for activities by math topic, thus facilitating access for users (either children or adults) who are looking for activities to support a particular content area.
- *Site maximization*: The site has been maximized to attract increased numbers of users through navigation external to the *Cyberchase* site, such as searching for “math games” in a search engine.

To gain insight into children’s use of the *Cyberchase* Web site, and evaluate the success of the *Next Frontier* redesign in achieving its aims, we conducted an analysis of Web analytics reflecting use of the site. This report presents our findings.

METHOD

Data for the analysis were taken from Google Analytics, and covered the first two months of the *Next Frontier*, from its launch on October 24, 2011 through December 24, 2011. This represented data from a total of 4,031,359 visits by 2,510,711 unique users (i.e. 2.5 million users, not counting repeat visitors). For the sake of comparison, data were also examined for the previous two months (i.e. before the redesign) and the same two-month period in the previous year.

To investigate navigation among activities within the site, we analyzed data for the site’s 100 most popular game, video, and hands-on activity pages. For the purposes of this part of the analysis, pages that did not contain activities (e.g., menu pages) were not included, so the 100 pages were actually drawn from the top 169 pages in the site.

As a means of gaining insight into user behavior, analyses of online data such as those

provided by Google Analytics pose both advantages and limitations. In comparison to in-person observations of users' interaction with a Web site, Google Analytics provides naturalistic data that reflect all of the users of the site – something that otherwise would be difficult or impossible to obtain for a site with literally millions of users, such as *Cyberchase*. At the same time, though, the depth and variety of information provided by Google Analytics is fairly limited. Without additional, custom-built software, it is not possible to obtain demographic information, such as the age, gender, or ethnicity of users, nor is it possible to explore navigation by following the paths that individual users take through the site. In addition, it is not possible to interview users about their behavior to find out why they made particular choices.

Nevertheless, by analyzing patterns of data among users as a whole, we have been able to gain insight into various issues regarding use and navigation of the *Cyberchase* site, and to draw inferences about the success of the *Next Frontier* redesign, as we shall see.

RESULTS

Overall Use

In only two months, the redesigned *Cyberchase* Web site generated a huge amount of traffic -- more than four million visits, from more than 2.5 million unique visitors (i.e. not counting multiple visits by the same user).

To determine how these figures compare to the site's past performance, we compared usage statistics for the first two months of the *Next Frontier* (10/24/11-12/24/11) to two other two-month periods: the previous two months of the same year (8/23/11-10/23/11) and the same two-month period in the previous year (10/24/10-12/24/10). The data from the previous two months provided insight into the most recent site usage before the redesign, whereas the data from 2010 controlled for the possibility that use might vary across different times of the year (particularly since the period between 10/24-12/24 includes Thanksgiving and the beginning of Christmas vacation, when children might have more time available to visit the site).

The following table presents statistics regarding overall use for the three periods examined:

	Next Frontier 10/24/11-12/24/11	Original site 8/23/11-10/23/11	Original site 10/24/10-12/24/10
Total visits	4,031,359	2,557,343	3,246,307
Unique visitors	2,510,711	991,072	1,177,483
Pageviews	14,004,923	19,041,913	27,295,443
Mean pages per visit	3.47	7.45	8.41
Mean time on site	00:03:45	00:06:06	00:06:58
Bounce rate	43.49%	23.54%	22.02%
% New visits	57.18%	31.02%	28.27%

As this table shows, although the previous performance of the *Cyberchase* Web site was already strong, *The Next Frontier* succeeded in attracting far more visits and far more visitors than in the past. The redesigned site attracted more than twice as many visitors and nearly twice as many visits as in the previous two months of 2011. Compared to the same two-month period in 2010, *The Next Frontier* showed an approximately 25% increase in visits and drew in more than twice the number of visitors as it had in the previous year.

As might be expected, the increase in visits and visitors was attributable (at least in part) to new visitors' coming to the site. Following the launch of *The Next Frontier*, most users were visiting the site for the first time (i.e. this was their first visit during these two months, although some of them might have also visited the site before October 24). By contrast, the bulk of the use both in the previous two months and in the previous year came from users who had been to the site before; only 1/4 - 1/3 of the use of the previous version of the site reflected new users.

In all likelihood, the increase in traffic, and especially in new visits, can be attributed to the site optimization that accompanied the *Next Frontier* redesign. Increasing the site's visibility to search engines probably drew in significant numbers of new users who may have been looking for things such as math games, in addition to those who specifically intended to visit the *Cyberchase* site itself.

Yet, despite the greater traffic for the *Next Frontier* and greater time spent, there were fewer pageviews after the relaunch (approximately 14 million) than in either the previous two months (about 19 million) or the previous year (27 million). Similarly, users spent a few minutes less on the site after the relaunch (an average of 3:45, versus approximately 6 or 7 minutes in the past). Part of this decline may be due to the new Learning Pathways, which allow a user to navigate directly from one activity to another. Before the redesign, users had to follow a longer path through menus, thus adding to the count of their pageviews, so the current, more streamlined navigation often allows users to travel through fewer pages (in less time) on their way to a given activity. Another significant factor is probably the site optimization, which makes it easier for users to follow a search engine's link straight to a particular *Cyberchase* activity, rather than having to visit the homepage and one or more menus first; again, this would reduce the number of pageviews along the way and take less time. In addition, as with any Web site, it is likely that some of the users who come to the site via search engines (without searching for *Cyberchase* in particular) discover that the site is not what they were looking for, and back out after viewing one page, thus bringing down the average number of pageviews and time spent.

Indeed, all of these explanations are supported by the following table, which shows that, following the relaunch, a far greater percentage of visits consisted of viewing only one page, and fewer visitors viewed 20 pages or more (as seen in the highlighted cells of the table):

Percentage of visits			
Number of pages viewed	Next Frontier 10/24/11-12/24/11	Original site 8/23/11-10/23/11	Original site 10/24/10-12/24/10
1	43.50%	23.54%	22.02%
2	16.80%	13.45%	11.30%
3	11.40%	11.78%	10.09%
4	6.39%	8.40%	9.12%
5	5.10%	6.60%	6.68%
6	3.26%	4.89%	5.10%
7	2.71%	3.97%	4.22%
8	1.90%	3.18%	3.44%
9	1.63%	2.70%	2.91%
10	1.18%	2.22%	2.45%
11	1.02%	1.90%	2.10%
12	0.78%	1.64%	1.82%
13	0.67%	1.41%	1.58%
14	0.53%	1.21%	1.39%
15	0.46%	1.08%	1.24%
16	0.37%	0.96%	1.10%
17	0.32%	0.85%	0.99%
18	0.26%	0.76%	0.87%
19	0.23%	0.68%	0.80%
20+	1.47%	8.80%	10.76%

Similarly, the following table shows that, following the redesign, the percentage of visits lasting 10 seconds or less nearly doubled (see the highlighted row of the table). The fact that these visits lasted less than 10 seconds suggests that they reflect users who were not actually planning to visit the *Cyberchase* site and exited immediately. These “inadvertent users” appeared to be responsible for reducing the average length of visits to the site. Indeed, if visits under 30 seconds are eliminated from the analysis (i.e. to focus on genuine users of the site), the time spent by visitors to the *Cyberchase* site after the *Next Frontier* relaunch was actually fairly similar to the time spent before the relaunch.

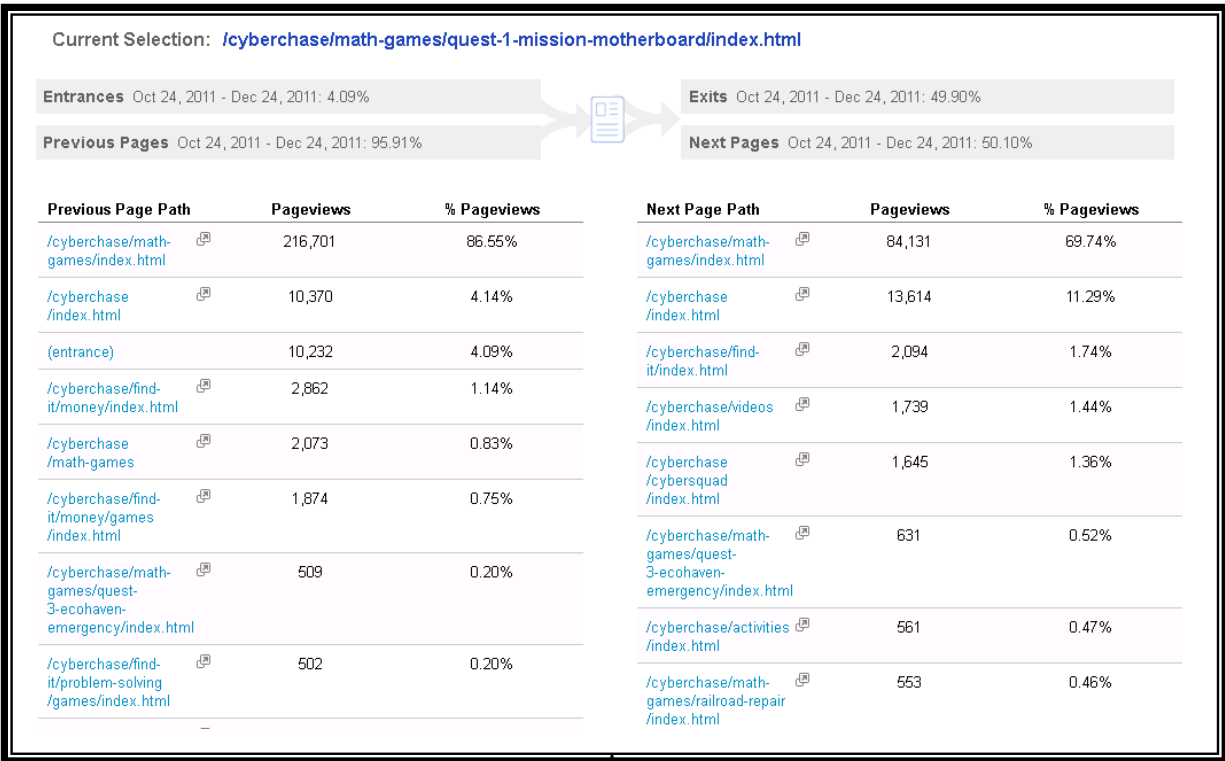
Time spent (minutes: seconds)	10/24/11-12/24/11	8/23/11-10/23/11	10/24/10-12/24/10
00:00-00:10	49.55%	29.99%	27.47%
00:11-00:30	10.03%	11.09%	9.74%
00:31-01:00	8.25%	9.11%	8.48%
01:01-03:00	11.05%	14.63%	14.54%
03:01-10:00	10.54%	16.65%	18.19%
10:01-30:00	7.92%	13.85%	16.04%
More than 30:00	2.66%	4.67%	5.55%

To summarize, it appears that the *Next Frontier* redesign and site optimization succeeded in driving more traffic to the site and in streamlining navigation within the site. This success resulted in sizable gains in the numbers of visits and visitors to the *Cyberchase* Web site (including new visits), but these gains came at the cost of a reduction in the number of pageviews and average time spent on the site.

Navigation: Learning Pathways

Unfortunately, in the absence of additional, custom-built software, Google Analytics cannot trace the path that individual users take through the site, so it is not possible to extract the number of games and activities that a user did over the course of a visit. Thus, we cannot determine conclusively whether the introduction of the Learning Pathways increased the number of related activities in which users engaged while visiting the site. (Indeed, the closest approximation that Google Analytics provides is a count of the mean number of pageviews per visit. However, this statistic would not be appropriate as a means to compare the number of activities used before versus after the redesign. As noted in the Overall Use section above, the *Next Frontier*'s streamlined navigation allows users to move from activity to activity while accessing fewer menus along the way. Thus, any comparison of pageviews before and after the redesign would likely be affected at least as much by the change in navigation as it would by the number of activities used.)

Nevertheless, although it is not possible to report the total number of activities used per session, we were able to obtain some information on navigation via Learning Pathways. Google Analytics permits tracking of one-step navigation from one page to another, by showing the sources of traffic for any particular page. For example, the following screenshot shows the entrances (i.e. where users came from) and exits (i.e. where they went afterward) for the Mission Motherboard quest game:



We analyzed traffic for a sample of the 100 most popular activity pages in the *Cyberchase* site (i.e. pages that presented games, videos, or hands-on activities -- not including the homepage, menu pages, the Find-It page, etc.). Specifically, we focused on entrances to each page, since that typically meant the page was not the first one visited and thus allowed some insight into navigation. By examining the sources of traffic to each page, we could tell how many times the page was accessed via menus within the site, how many times it was accessed via each of the Learning Pathways (by seeing how often the source was another activity page that was linked through one of the Learning Pathways), and how often it was the first page the user visited (e.g., if a user typed the page's URL directly into his or her browser, or accessed a particular video or game through an external search engine).

In all, during the first two months after the redesign, Learning Pathways were used 75,877 times to access these 100 pages. The following table breaks out the data by type of page (games, videos, hands-on activities) and source of navigation (menus, Find-It, each type of Learning Pathway, miscellaneous, or first page visited):

PAGE ACCESSED VIA:	Games (N = 46)		Videos (N = 45)		Hands-on (N=9)	
	Pageviews	Percent	Pageviews	Percent	Pageviews	Percent
First page visited	675,060	20%	265,884	62%	6,492	9%
Menus	2,532,058	75%	128,590	30%	59,960	80%
Find-It	88,956	3%	19,651	5%	6,166	8%
LP math	50,735	2%	10,530	2%	1,630	2%
LP character	6,947	0%	2,613	1%	344	0%
LP surprise me	2,991	0%	79	0%	8	0%
Misc	2,384	0%	2	0%	0	0%
TOTAL	3,359,131	100%	427,349	100%	74,600	99%

Several trends are revealed in this table:

- Interestingly, different kinds of pages (games, videos, hands-on activities) tended to be reached in different ways. As might be expected, menus were the most common means to reach games and hands-on activities, but videos were most often accessed directly from outside the site (e.g., through search engines or other means).
- Within the site, menus continued to be most popular option for navigation, followed by the Find-It page and Learning Pathways.
- It is, perhaps, surprising – but gratifying – that, of the three kinds of Learning Pathways (math, character, and “surprise me”), users most often chose to navigate by math. In all, users used the math Learning Pathways 62,895 times for navigation, which is approximately six times as often as character (9,904) and 20 times as often as “surprise me” (3,078). On literally tens of thousands of occasions, users followed one activity with another that dealt with similar math content, thus reinforcing the educational experience.
- It is also noteworthy that both the math and character Learning Pathways were used far more frequently than “surprise me.” We cannot be certain why this was the case, but one possibility might be that children prefer to choose activities consciously, rather than (seemingly) at random.

As noted above, although the Learning Pathways received substantial use, menus were the most popular navigation option within the site (i.e. not counting users who came to a particular activity directly from outside the site). However, the word “menus” actually includes several different type of navigation via menu – navigation via either the homepage, the menu for that type of activity (e.g., using the games menu to find a game), or traffic coming from a different menu within the site. The following table breaks out menu navigation by these different types of menus:

Menu Breakout						
Type of menu	Games		Videos		Hands-on	
	Pageviews	Percent	Pageviews	Percent	Pageviews	Percent
Homepage (callout + back button)	163,565	6%	125,456	97%	40,183	67%
Own menu	2,536,033	94%	578	0%	18,909	32%
Other menus (back button)	492	0%	3,559	3%	848	1%

Breaking out the different types of menus reveals several additional trends:

- Like navigation as a whole, patterns of menu navigation differ between games, videos, and hands-on activities. Almost all of the traffic to games came from the games menu. By contrast, traffic to videos and hands-on activities stemmed far more often from callouts that promoted a specific video or hands-on activity on the homepage. (Note that this table does not include instances in which users accessed a specific activity directly from a link outside the *Cyberchase* site. As noted earlier, such sources were the primary source of traffic for videos.)
- However, we must exercise a bit of caution in drawing conclusions about menu navigation, because there are actually two ways in which users could reach a particular activity from a menu. One obvious method is by navigating forward -- that is, users could go to the game menu and then select a game that they want to play (e.g., Railroad Repair). Conversely, a user could navigate backward instead -- for example, by playing Railroad Repair, then clicking the “games” button to access the games menu, and for whatever reason (e.g., wanting to play Railroad Repair again, or deciding against playing any more games) clicking the back button on their browsers to back out of the menu and return to Railroad Repair. The forward and backward paths would both register in Google Analytics as navigating from the games menu to Railroad Repair.

In fact, we know that at least some of the navigation via menus actually consists of users backing out of a menu and returning to their prior activity. As the last row of the above table indicates, a small percentage of traffic consisted of users’ reaching an activity from an unrelated menu (e.g., coming to a game from the video menu). Since there is no way to jump directly from the video menu to a specific game in a forward direction, these users must have been backing out of the video menu to return to the game that they had played immediately beforehand. That is, they played a game, clicked on the “videos” button at the top of the page, and then backed out of the video menu to return to the game. Unfortunately, there is no way to know how much of the traffic in the top two rows of the table actually represents backward navigation. In light of the relatively small percentages in the last row of the table, however, it is likely that backward navigation contributes slightly to the figures in the top two rows, but it

probably is not a hugely significant factor.

Find-It

The Find-It page was created to facilitate searching for games, videos, and activities regarding a given mathematical topic, such as fractions or measurement. During the first two months after its launch, the Find-It page received a great deal of use, with nearly one half-million pageviews (466,586) by 337,948 unique visitors. (Note that comparisons to navigation before the launch of *The Next Frontier* are not possible because the Find-It page did not exist before the redesign.)

The following table shows the number of users who clicked on each of the buttons on the Find-It page, organized according the layout of the buttons on the page:

Find-It Button	Number of Users	Find-It Button	Number of Users
Fractions	89,957	Geometry	31,008
Holidays	57,846	Math & Sports	31,310
Math & Weather	28,601	Measurement	24,573
Money	42,355	Pre-algebra	19,412
Problem Solving	18,974	Science/Engineering	12,777
Using Data	14,782	Using Numbers	15,637

As this table shows, use of the individual buttons/math topics seemed to depend (at least to some degree) on the order of buttons of the page. In most cases, users were more likely to click the buttons that were located near the top of the page, and to click buttons in the left column more than the right. The most notable exception was the Money button, perhaps because of the attractiveness of money as a topic.

CONCLUSION

Taken together, the data from this analysis indicate that *The Next Frontier* succeeded in achieving its goals of increasing traffic to the *Cyberchase* Web site, providing opportunities for users to search for material addressing a given math topic, and reinforcing learning by encouraging users to engage in multiple activities regarding related math content. During the first two months of *The Next Frontier*, more than 2.5 million users visited the site – far more than had visited the site previously -- including a sizable proportion of new users.

The Find-It page was used more than 400,000 times during these two months, and the Learning Pathways were used more than 75,000 times (including more than 60,000 instances in which users followed one activity by selecting another activity with related math content). Thus, significant numbers of users searched specifically for particular math content (most often fractions), and chose to engage in related activities with the potential to reinforce learning.

As noted at the beginning of this report, Web analytics are limited in the types of information they can provide. The present data cannot tell us about users' age, gender, or ethnicity, nor can they lend insight into what users learned from their experience on the Web site. Further research, in which researchers interact directly with users, would be needed to answer these questions. To that end, however, it is worth noting that the results of past summative studies have shown that use of *Cyberchase* does indeed contribute to significant gains in children's mathematical problem solving (e.g., Fisch, 2003; Fisch et al, 2010; Rockman Et Al, 2002).

Although the data from the present analysis cannot add directly to the accumulated evidence of learning from *Cyberchase*, the large numbers of users who searched for math topics via the Find-It page and/or pursued related math content through Learning Pathways are very encouraging. The results of this analysis suggest that many users were motivated to search for and engage in mathematics content on the site, and *The Next Frontier* provided new opportunities for them to do so. In-person research will be needed to document the outcomes of that enhanced engagement.

REFERENCES

- Fisch, S.M. (2003). *The impact of Cyberchase on children's mathematical problem solving: Cyberchase season 2 summative study*. Teaneck, NJ: MediaKidz Research & Consulting.
- Fisch, S.M., Lesh, R., Motoki, E., Crespo, S., & Melfi, V. (2010). *Children's learning from multiple media in informal mathematics education*. Teaneck, NJ: MediaKidz Research & Consulting (with Indiana University/PRISM Learning and Michigan State University).
- Rockman Et Al. (2002). *Evaluation of Cyberchase phase one pilot study: Vol. 1, executive summary*. San Francisco, CA: Author.