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Converging Industries Research Foundation

Practical Solutions for Communications Policy

Schools in Cyberspace: The Cost of Providing Broadband Services to Public Schools

Executive Summary

July 1, 1995
Presentation at the July 1995 NARUC Meeting,
San Francisco, CA

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Project Information

Telecommunications Industries Analysis Project:

Schools in Cyberspace: The Cost of Providing Broadband Services to Public Schools

Carol Weinhaus, Teresa Pitts, Linda Garbanati, *et al*.
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The Telecommunications Industries Analysis Project is associated with the Public Utility Research Center at the University of Florida College of Business Administration.

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Project Information, cont.

Background on the Telecommunications Industries Analysis Project

The goal of the Telecommunications Industries Analysis Project is to provide information to support the development of alternative communications policies to meet the needs of stakeholders in an environment that includes competitive and non-competitive markets, federal and state regulatory jurisdictions, and a proliferation of new services made possible by technological advances. The purpose of the project is to produce research and analysis which will assist policy makers in making informed decisions.

The project is a neutral forum of communications industry stakeholders exploring multiple viewpoints of selected issues. This forum incorporates the following elements:

- **Broad representation:** The current forum includes foreign and domestic local exchange carriers (LECs), interexchange carriers (IXCs), materials and equipment manufacturers, and federal and state regulators. The project actively seeks expansion of this forum to include other communications industry representatives such as competitive access providers, cable television companies, computer companies, electric power utilities, or publishers.

- **Multiple viewpoints:** Participants are required to play an active role in the research and analysis, to represent their own interests, to understand and to assist in developing others' perspectives, and to work toward the common goal of representing multiple views.

- **Analysis and results of alternative policies:** Research tools, including a jointly produced data base and computer software models, and data analysis developed by this forum create a common language for examining issues. The common language allows the participants to focus on underlying issues. Appropriate computer software tools, including modifications to existing tools, are developed.

- **All data, analysis methods, and results are public:** Data used by this project must be publicly available on a nationwide basis. Research products become public domain information.

- **Neutral setting**: The project resides in a neutral setting, free of partiality, thereby ensuring objective and independent research.

The Cost of Providing Broadband Services to Public Schools

Executive Summary

Objective

This paper gives policy makers information on the cost of providing public schools with broadband access to traditional telephone networks and emerging new networks (such as video networks and the Internet) via the local exchange carriers (LECs). The costs in this paper are for one type of broadband technology.[1] The results in this paper supplement existing studies.[2] Although this paper assumes that the broadband infrastructure is provided by LECs, in practice educators may choose other network suppliers.

Broadband Modeling Results

The additional LEC network investment for providing schools with broadband services is very low compared to school investment and equipment costs. This is also true for providing wideband services. Most of the cost of providing new technologies is driven by two factors:

- Deploying technologies too fast.
- Providing schools with computing equipment, wiring, and training.

Definitions of Deployment Schedules and Scenarios Modeled

Two deployment schedules for public schools are compared - a 20-year nationwide broadband deployment and a 5-year accelerated deployment for broadband access and school equipment. Both schedules assume a nationwide, ubiquitous deployment of a broadband infrastructure in the LEC telecommunications networks over a twenty year period. To provide valid comparisons between the two deployment schedules, the modeling cost results are based on comparisons of twenty year periods for all three access-to-technology scenarios: teacher only (only one computer per classroom), team of students (seven computers per classroom), and universal (every student and teacher has a computer). The data are for public schools only, kindergarten through twelfth grade.

Range of Broadband Costs

The range of total costs for the 20-year broadband deployment is $14.7 billion for the teacher-only access scenario to $118.3 billion for the universal access scenario. The range for the 5-year accelerated deployment for these two scenarios is $28.6 billion to $204.4 billion.

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[1] Technology that supports data rates of 45 Mbps (Megabits per second) or greater is called broadband. The broadband platform can support both MPEG-II and 45 Mbps or greater

[2] Russell Rothstein and Lee McKnight, "Connecting K-12 Schools to the NII: A Preliminary Assessment of Technology Models and Their Associated Costs," U.S. Department of Education Working Paper, August 4, 1994. Rothstein and McKnight, "Technology and Cost Models of K-12 Schools on the National Information Infrastructure," Massachusetts Institute of Technology, Cambridge, MA, February 10, 1995.

- **LEC Network Investment Costs are Dwarfed by School Costs**
  LEC network investment costs are dwarfed by the school costs, especially as the number of computers per classroom approaches the number of students per classroom. In the case of universal deployment of computers (a computer on every desktop), even the expense associated with software upgrades and Internet access charges rapidly exceeds the LEC network investment costs (**Figures 1 and 2**). LEC network investment costs are $10.2 billion for the 5-year accelerated deployment and $2.2 billion for the 20-year deployment. Depending on the scenario, these costs range from 1.9% to 35.6% of total costs. This pattern of relatively high investment by schools, low investment by LECs is especially evident in the most extensive scenario (universal access). While not as extreme, this same pattern also holds true for the simplest scenario (teacher-only access) which provides only one computer per classroom.

- **Accelerating Deployment Increases LEC Network Investment Costs**
  If broadband deployment to public schools is accelerated to five years instead of integrated as part of a 20-year nationwide deployment, LEC network investment costs are approximately five times as much ($10.2 billion compared to $2.2 billion). Acceleration of deployment to the schools produces significantly higher costs. This is due to the fact that more equipment is purchased in the early stages when prices are higher and to the fact that there will be little sharing of common facilities and civil works with other customers. The 20-year schedule shows the cost advantages for sharing network investment over all available services. In this case, investment is stimulated by wider market demand and an integrated cost-effective modernization of facilities.

- **LEC network investment costs are indifferent to the number of PCs per classroom**
  Data rates supported by broadband equipment and fiber-optic cable are so great that these costs are insensitive to the variation in the demand for data services due to the number of PCs.

- **Incremental Investment per Student per Year may be High or Low**
  The incremental investment per student per year (Figures 3 and 4) indicates that the universal access scenario costs approximately twice as much as the team of students scenario and approximately seven times as much as the teacher-only access scenario. Incremental investments remain relatively constant over time for these two less extensive deployments.

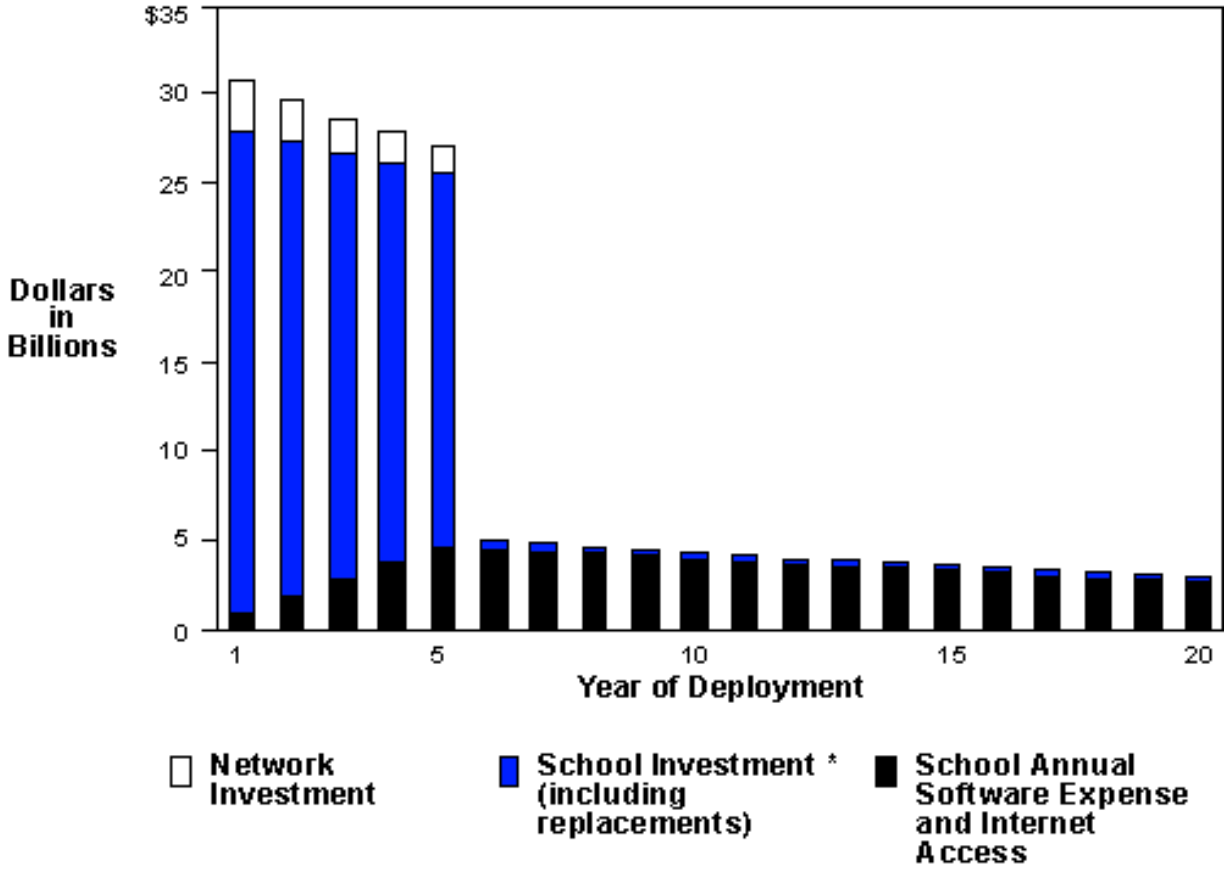
  In terms of the incremental investment per student per year, the decision to accelerate broadband deployment beyond the nationwide deployment produces an effect that isn't erased with time. This difference is most evident in the comparison of 5-year and 20-year deployments of the universal access scenario (Figure 5). By the sixth year, the investments diverge dramatically. To a lesser degree, this same pattern appears in the teacher- only access and in the team-of-students access scenarios.

In 1992 public school expenditures per student were approximately $5,200. A comparison of this number with the results from the model (Figures 3 and 4), indicate potential for increased expenditures. However, it is difficult to determine the impact of new technology on existing expenditures. For the universal access scenario,

Public Debate over Expenditures for Schools

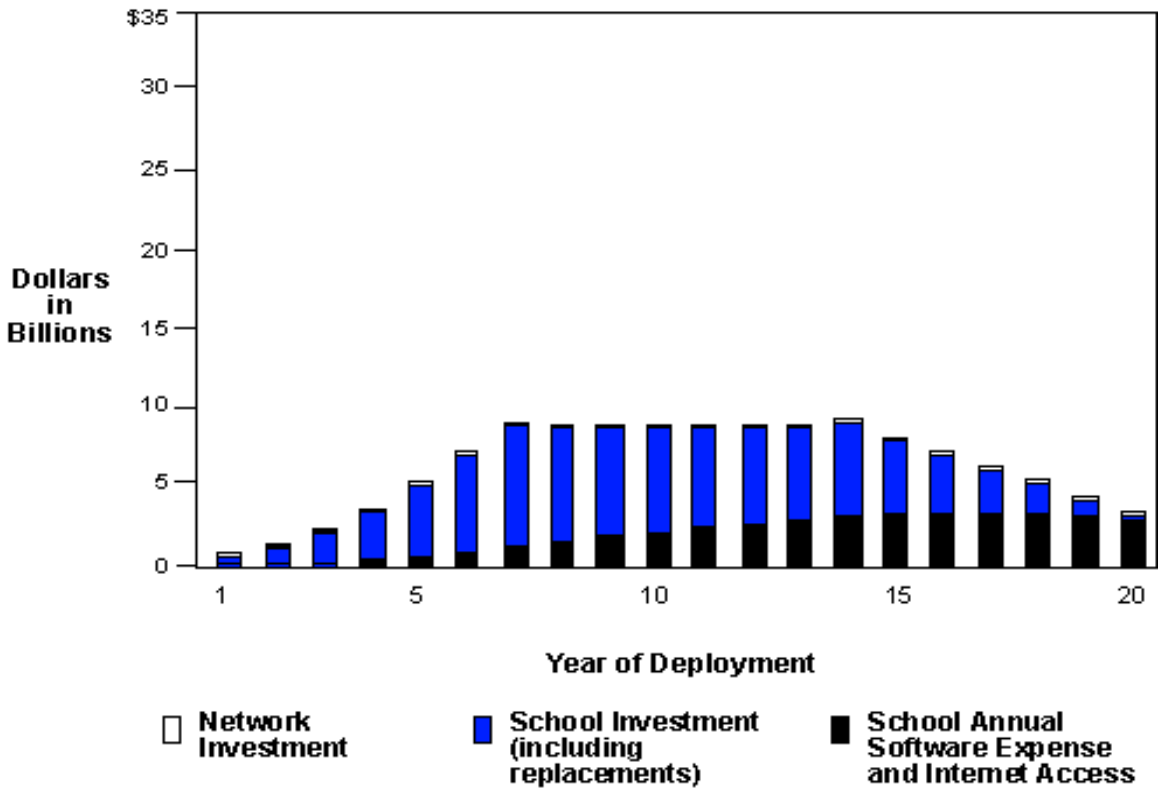
The deployment of broadband technology to schools is only one area in a larger debate over public expenditures for schools. One view is that the federal government should play a leading role in getting broadband services to schools. Another view prefers local control. Yet other views combine these extremes and see a need for a federal framework within which local officials decide how information technologies can be used to prepare U.S. students for a competitive, global economy. Regardless of the view that is taken, educators and policy makers need information on technology costs to help them to make informed decisions.

Figure 1: **Comparison of School Costs with LEC Network Costs:**
5-Year Accelerated Broadband Deployment, Universal Access



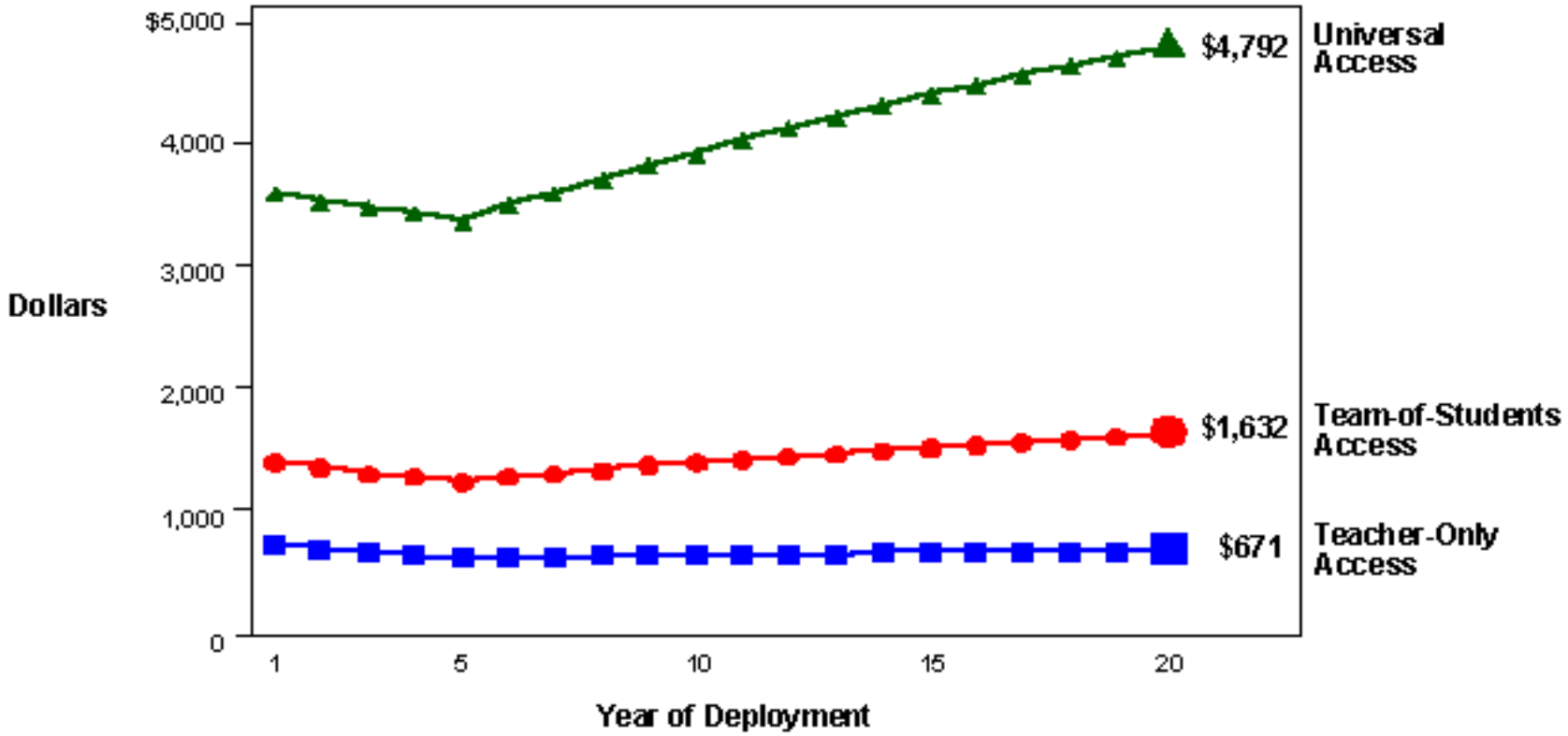
* In the 5-year accelerated deployment, replacement costs for school investment in computers, etc., is minimal in relationship to the initial investment and, therefore, is not immediately visible in years 6 though 20. Modeling the costs out to 20 year allows comparisons with the 20-year deployment.

Figure 2: **Comparison of School Costs with LEC Network Costs: 20-Year Broadband Deployment, Universal Access**



* In the 5-year accelerated deployment, replacement costs for school investment in computers, etc., is minimal in relationship to the initial investment and, therefore, is not immediately visible in years 6 though 20. Modeling the costs out to 20 years allows comparisons with the 20-year deployment.

Figure 3: **Incremental Investment per Student per Year for Three Access Scenarios: 5-Year Accelerated Broadband Deployment**



*Modeling the costs out to 20 years allows comparison between the 5-year accelerated and the 20-year deployment schedules.

Figure 4: **Incremental Investment per Student per Year for Three Access Scenarios: 20-Year Broadband Deployment**

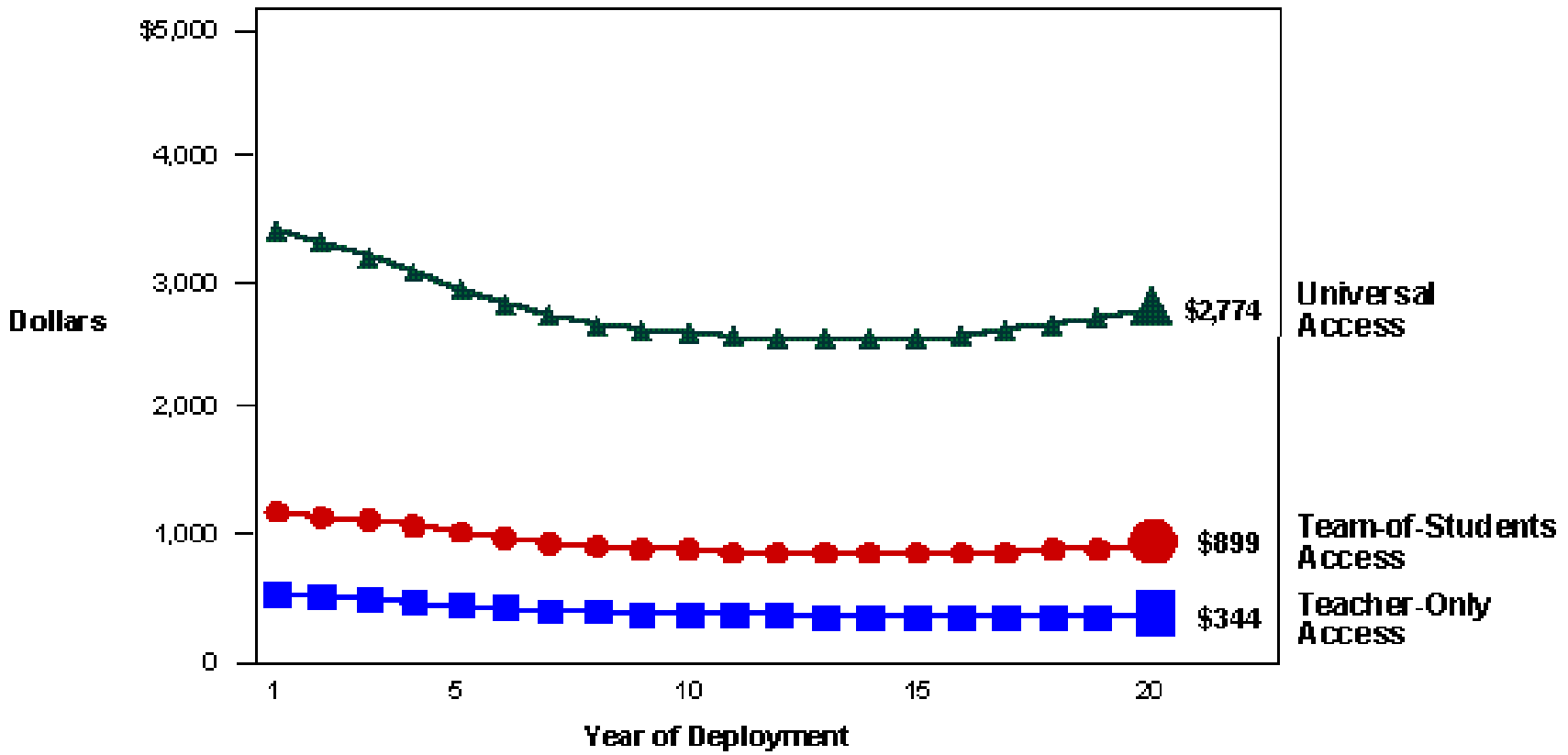
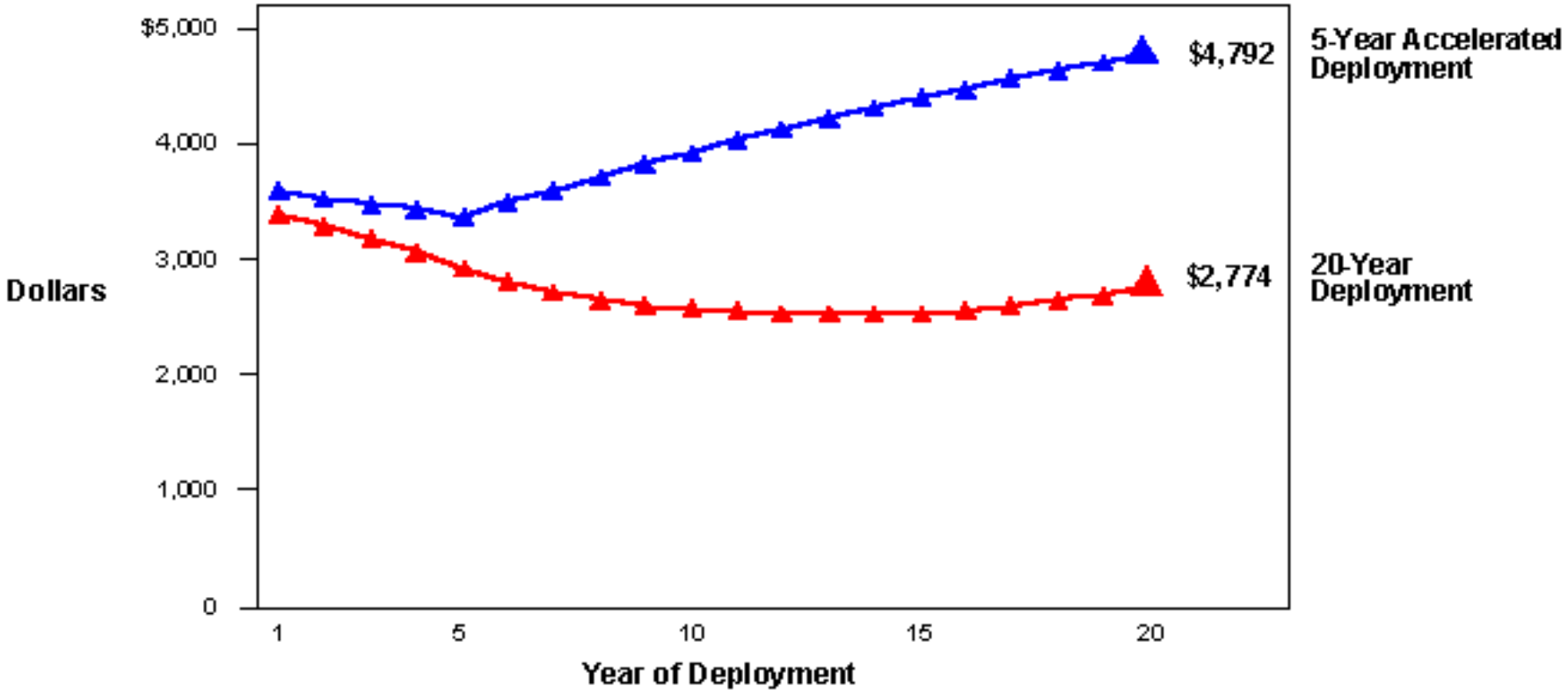


Figure 5: **Incremental Investment per Student per Year for Universal Access (Scenario 3): 5-Year Accelerated and 20-Year Broadband Deployment**



*Modeling the costs out to 20 years allows comparison between the 5-year accelerated and the 20-year deployment schedules.