

Instructional Technology Investments in U.S. Schools

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Teaching, Learning, and Computing: 1998

The National Survey of Computer Technology and Instructional Reform

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The School Sample in TLC

- A representative sample of all U.S. schools, public and private (Probability Sample: 655 schools participated--75% rate)
 - Inventories & Support Effort from 467 Tech Coords.
 - Detailed Expenditure Data from 310 Tech. Coords.
- The “Purposive Sample”
 - 378 schools from more than 50 major reform projects
 - 182 schools with high-end technology

The Teacher Sample in TLC

- Over 4,100 teachers from grades 4-12 participated, nearly 70% of those sampled
 - Completed 20 page questionnaires
 - Four different versions; heavily overlapping questions
- The sampling process disproportionately selected active computer-users and reform-oriented teachers.
 - BUT data was re-weighted to reflect a “simple random sample” of teachers

Investment in Technology

Estimate of Recent Expenditures (1997-1998):

- Average of estimates for 1996-98 expenditures on behalf of school by both school & district for...
 - 7 types of hardware expenditures
 - 2 types of software
 - 4 types of support and training for teachers

Measures of Current Infrastructure:

- Inventory of computer and networking resources.
- Number of computers able to access 20 types of software.
- Technology coordinator's weekly time spent on 7 types of training, coordination, and user support activities, extrapolated for five year period.
- Time spent by other persons providing support regularly.

Per-Student Expenditures in US Schools, 1997-98

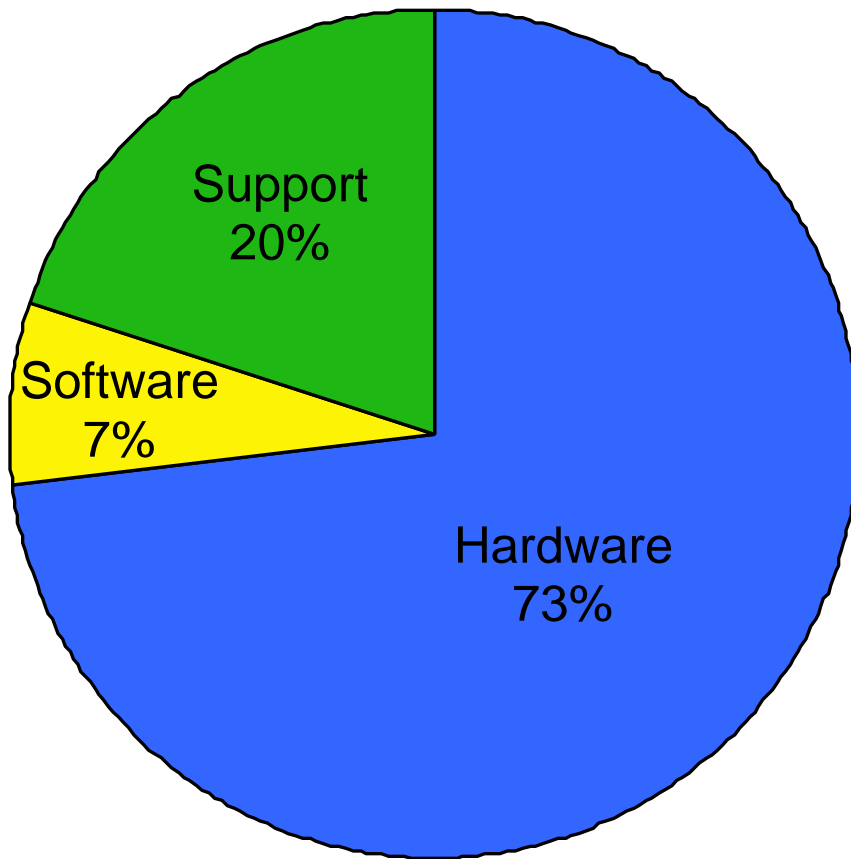
	<u>Total</u>
Instructional Computers	\$42.40
Peripherals	5.70
Video Production	1.10
Computer Furniture	2.30
Local Area Network	13.60
Internet	3.40
Computer Maintenance	3.40
Total Hardware	82.70
Grand Total	\$113.20

Per-Student Expenditures in US Schools Cont'd

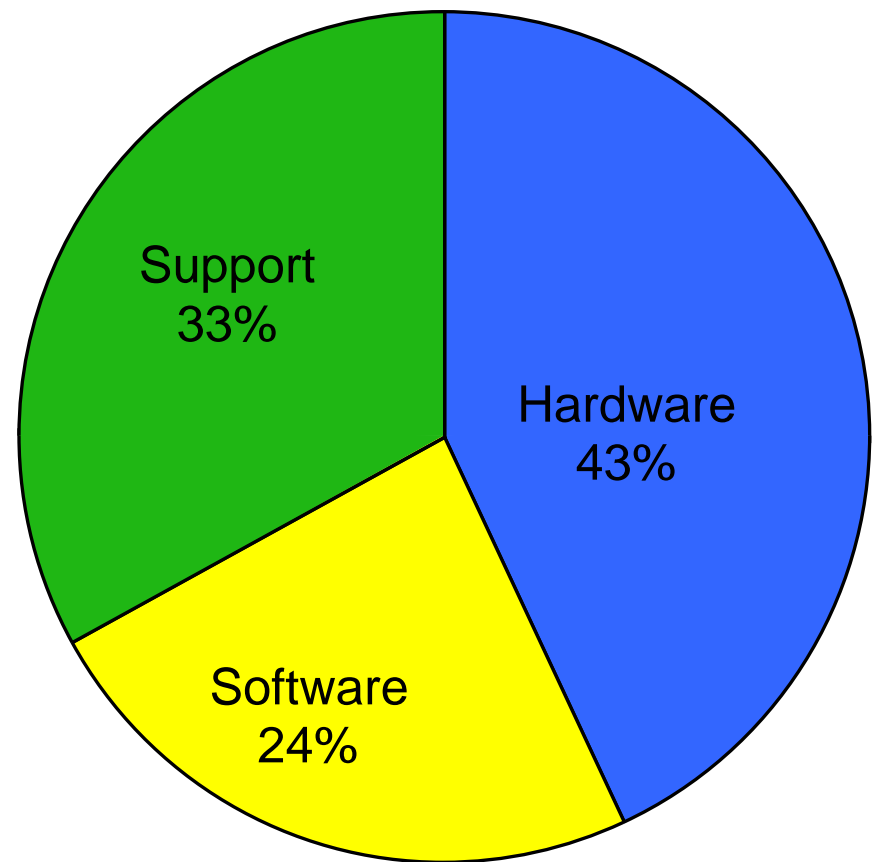
	<u>Total</u>
Individually Purchased Software	\$4.50
Site Licenses	3.40
Total Software	7.90
Salary for Tech Coordinator	11.30
Salaries for Others Providing Training	4.50
Release Time, Training Expenses	4.50
Other Expenses for Support	2.30
Total Support	22.60
Grand Total	\$113.20

Instructional Technology Expenditures by US Schools

What Schools Spend



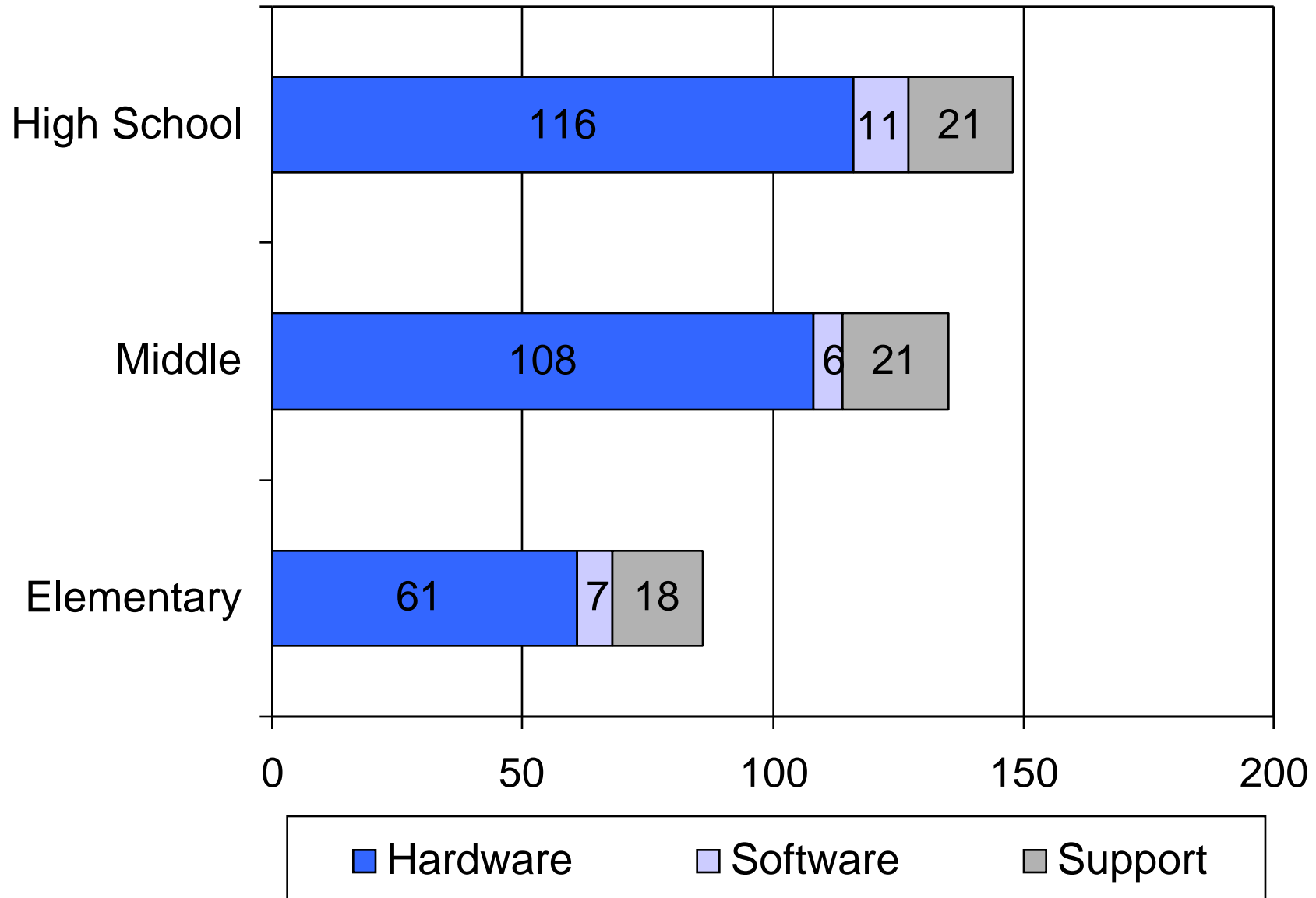
What Tech Coordinators Want



Major Findings

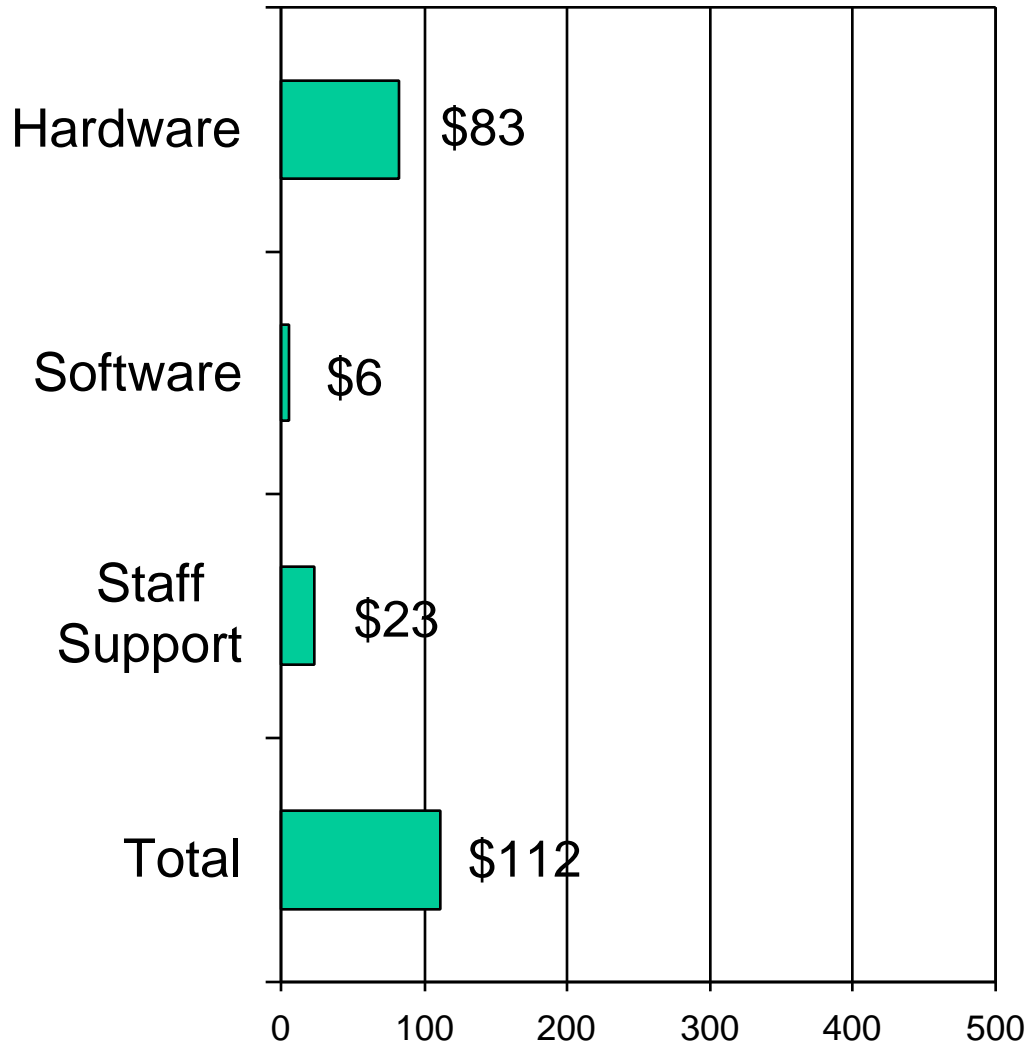
1. Most \$ are spent on hardware, not software nor support
2. This contrasts with what technology coordinators say they want most.
3. It also is inconsistent with what major studies (e.g., OTA) and expert panels (e.g., PCAST) claim is needed for effective integration of technology into curriculum.

Average Annual Per-Student Technology Expenditures (\$) by School Level

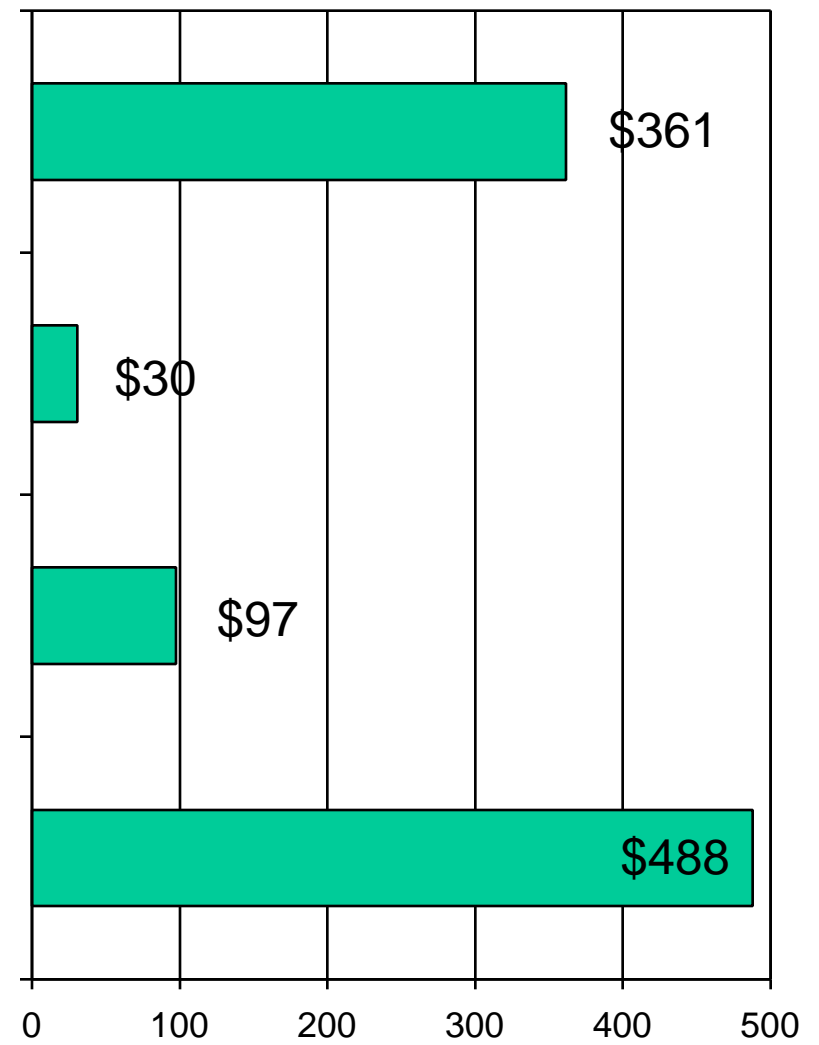


Average Per Student Technology Investment in US Schools

FY98 Expenditure



Five Year Estimate



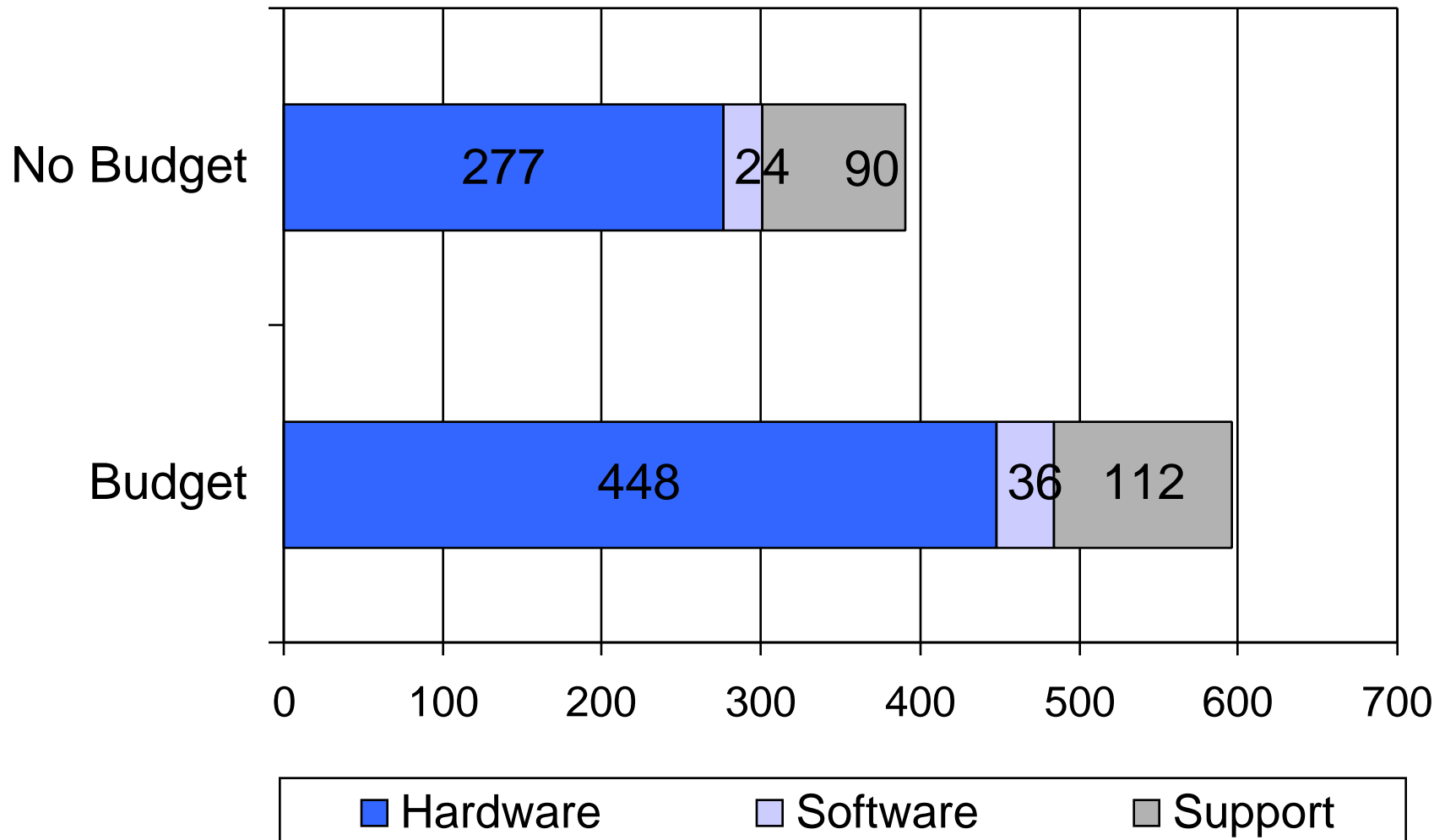
Findings on District vs. School Spending:

- Technology specialists/coordinators attribute nearly half (46%) of technology spending to the districts rather than the school
- Districts spend somewhat more for hardware; schools spend more for software and support

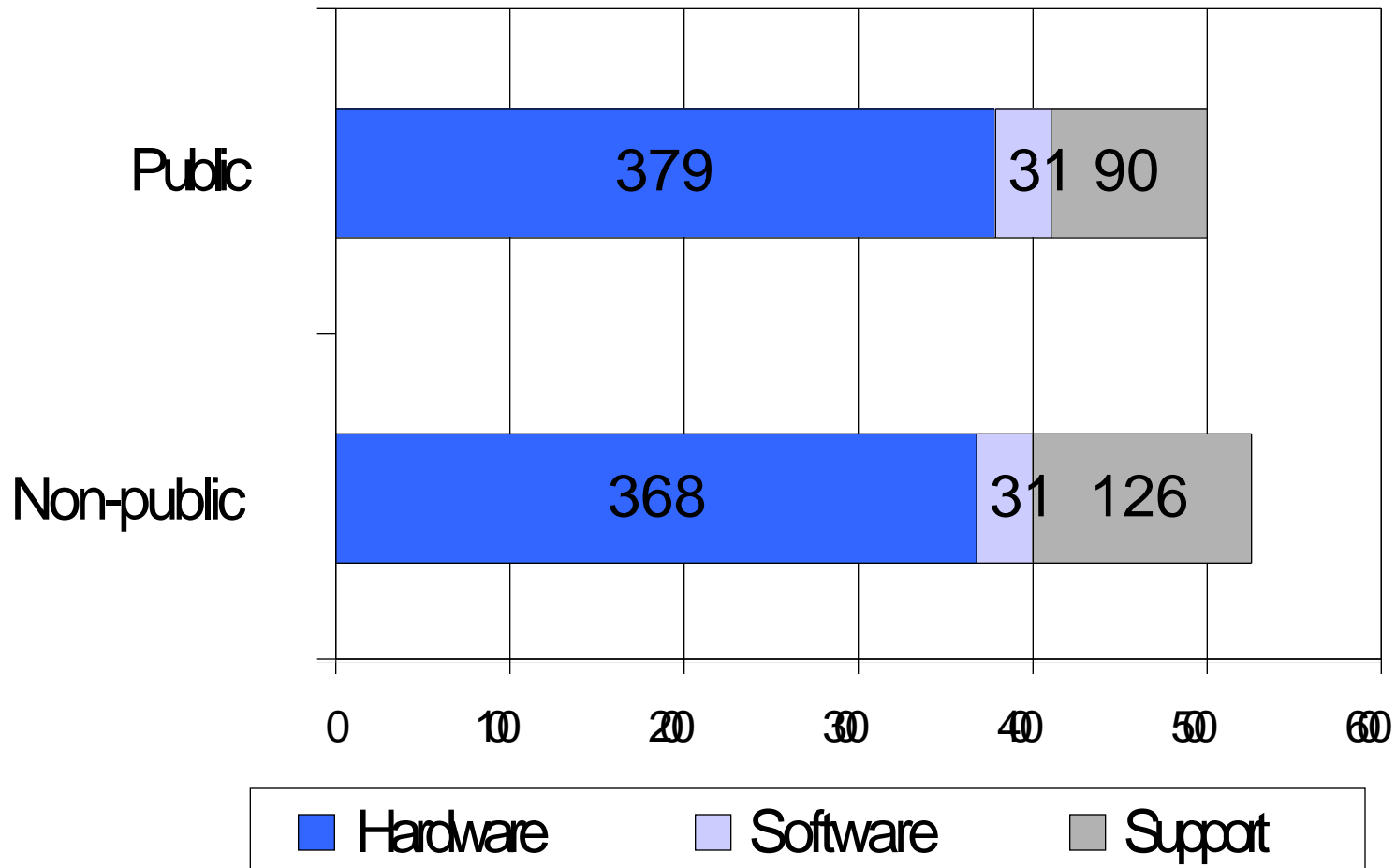
Do Schools Have Their Own Budgets?

- Only 54% of principals said they had their own budget for technology -- where the school has sole discretionary authority
- This proportion was essentially the same across all three school levels

Schools With Their Own Budgets Invest More on All Three Categories of Technology: Size of Current Infrastructure Per Capita (index scores are rough 5-year \$ per-student estimates)



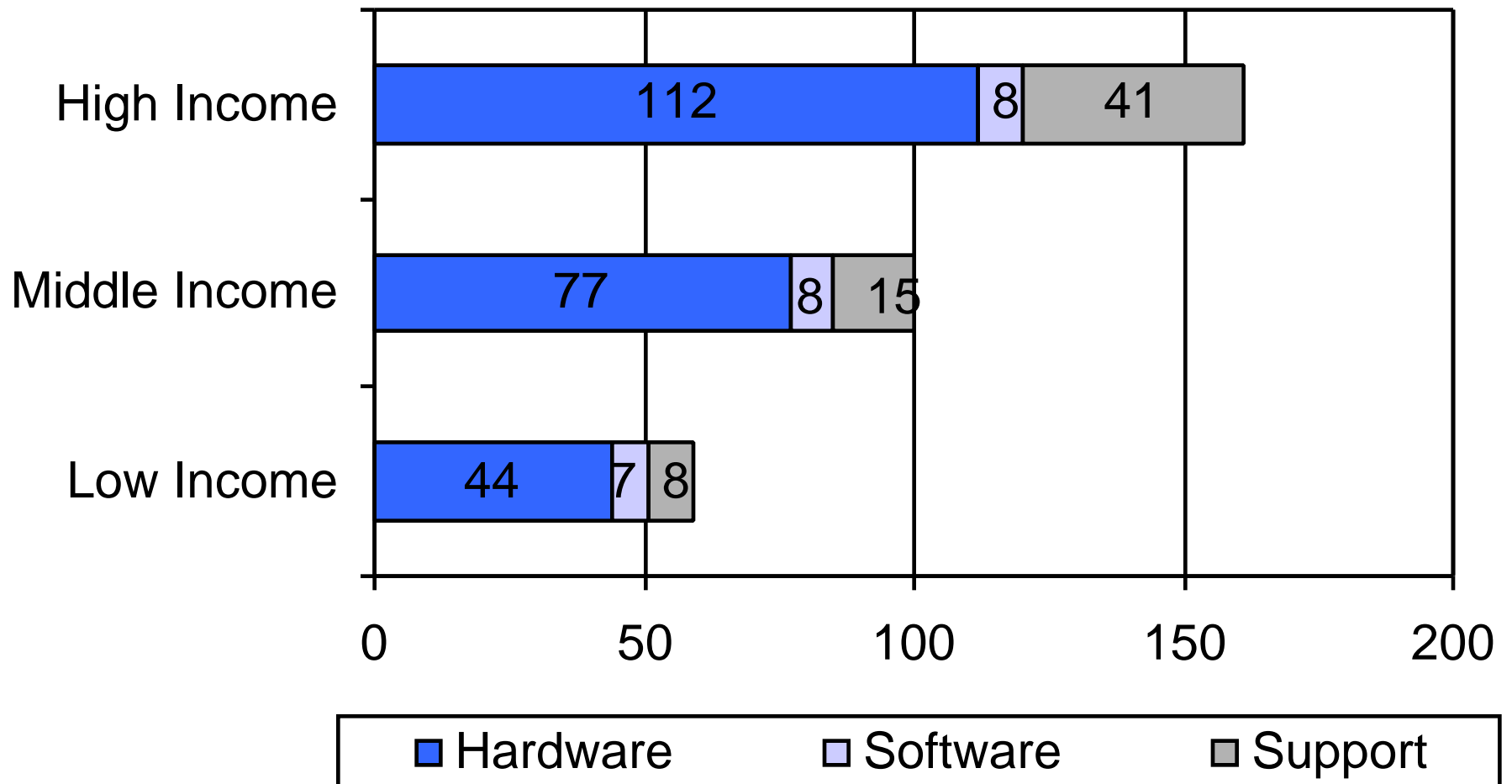
Non-Public Schools Invest More Than Public Schools on **Support**: Size of Current Infrastructure Per Capita



In 1997-98, Schools in Higher Income Communities

(as measured by ZipcodeFamily Income)

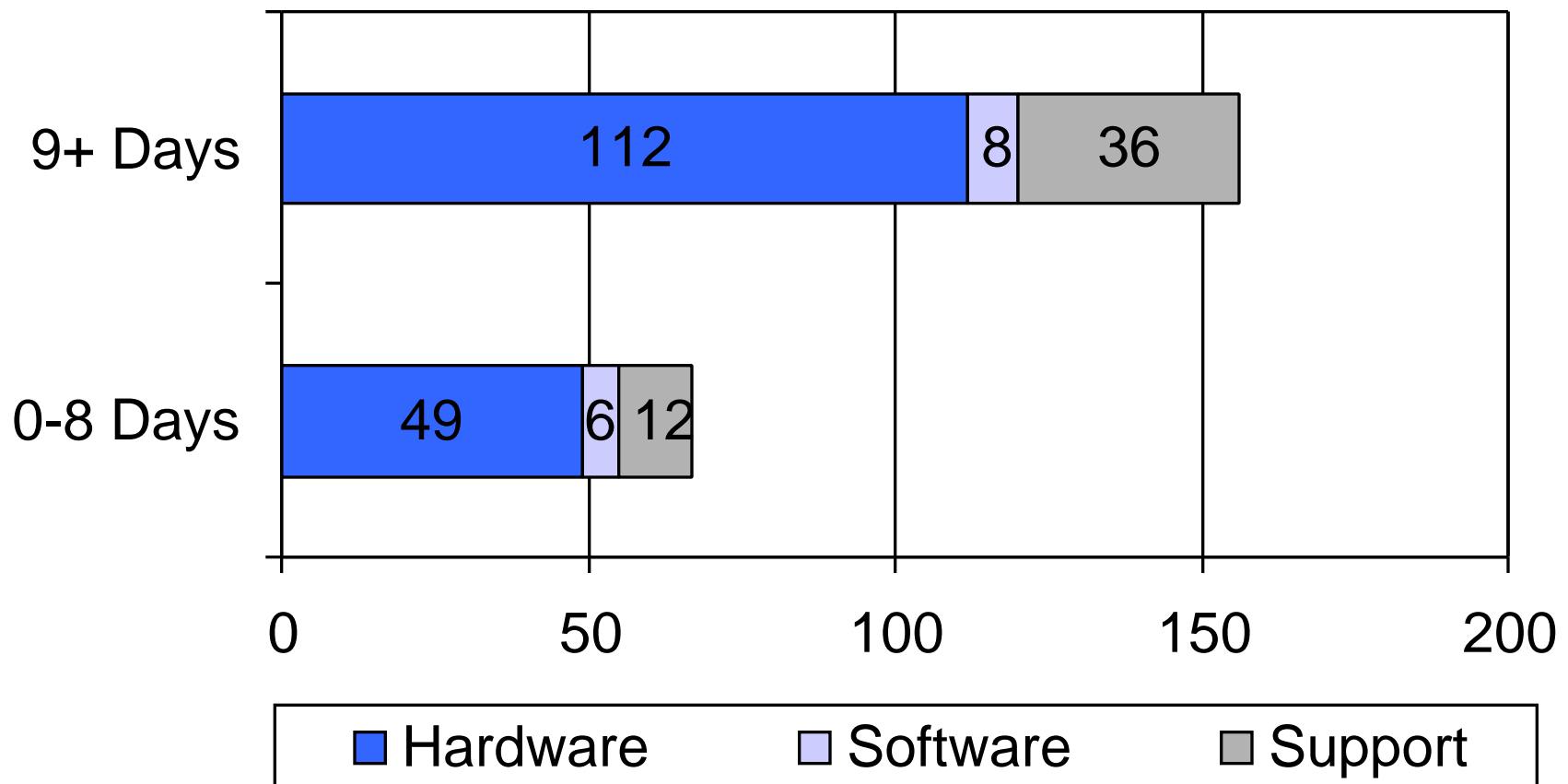
Spent Much More for Hardware and Support: Average Per Student Technology Expenditures



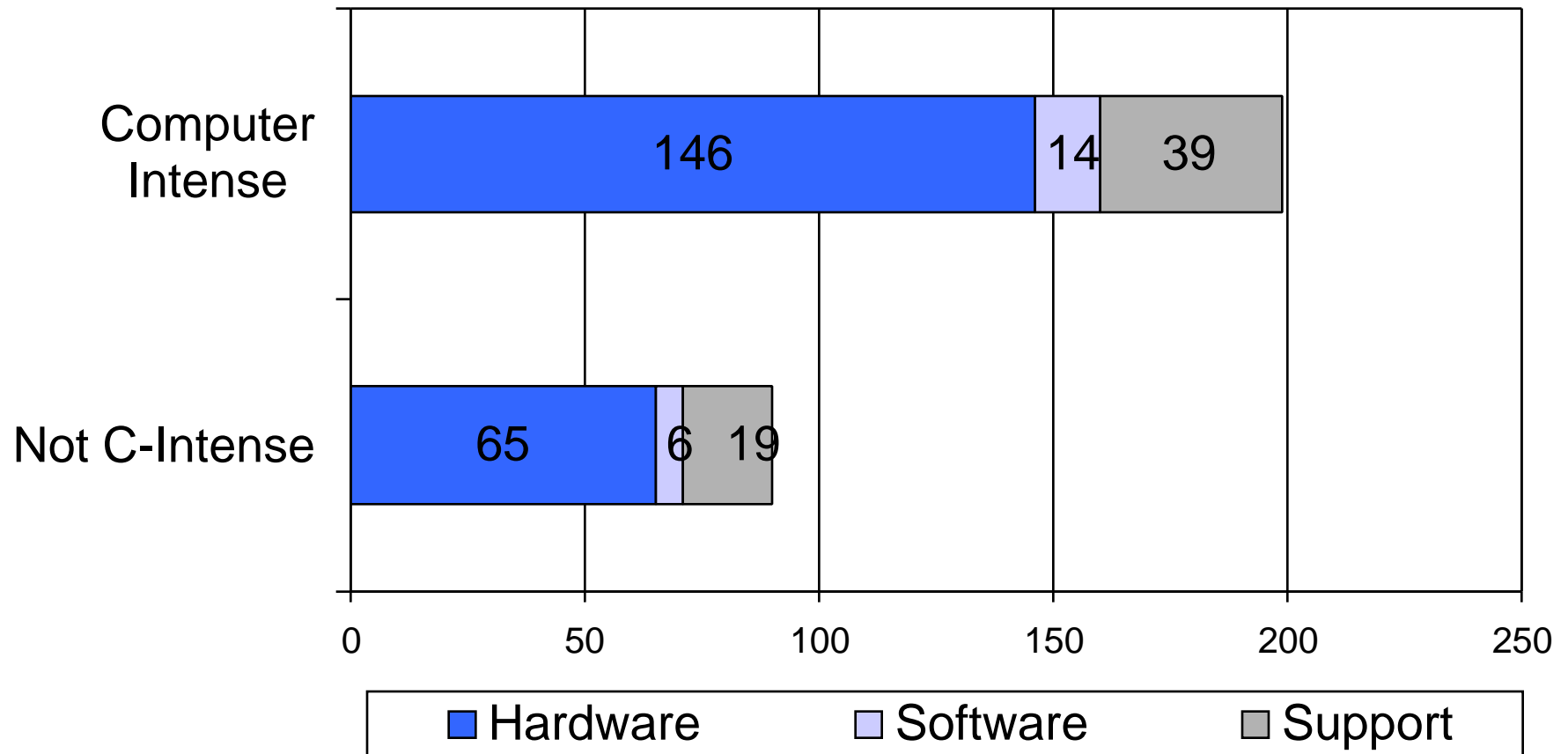
Principals Who Spend More Time on Technology Issues

(40% of Principals)

Invest More on Hardware & Support: Average Per Student Spending, 1997-98



Schools Already Computer-Intensive Spent More on Technology in Current Year



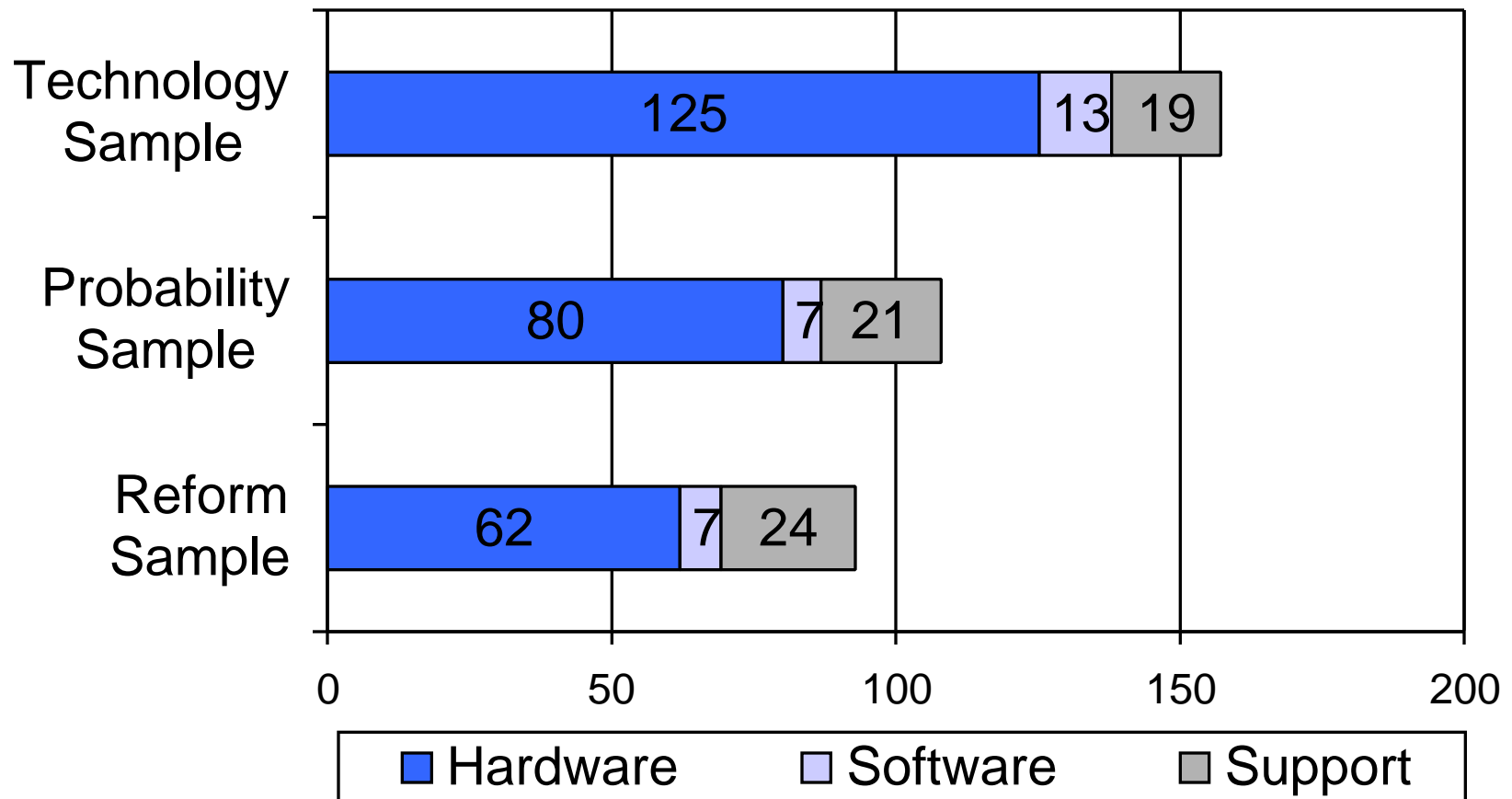
Computer Intense: student-computer ratio under 6.5 and at least 25% of computers were multimedia-ready. About 25% of the probability sample met this criterion.

Schools Recognized for Their Technology

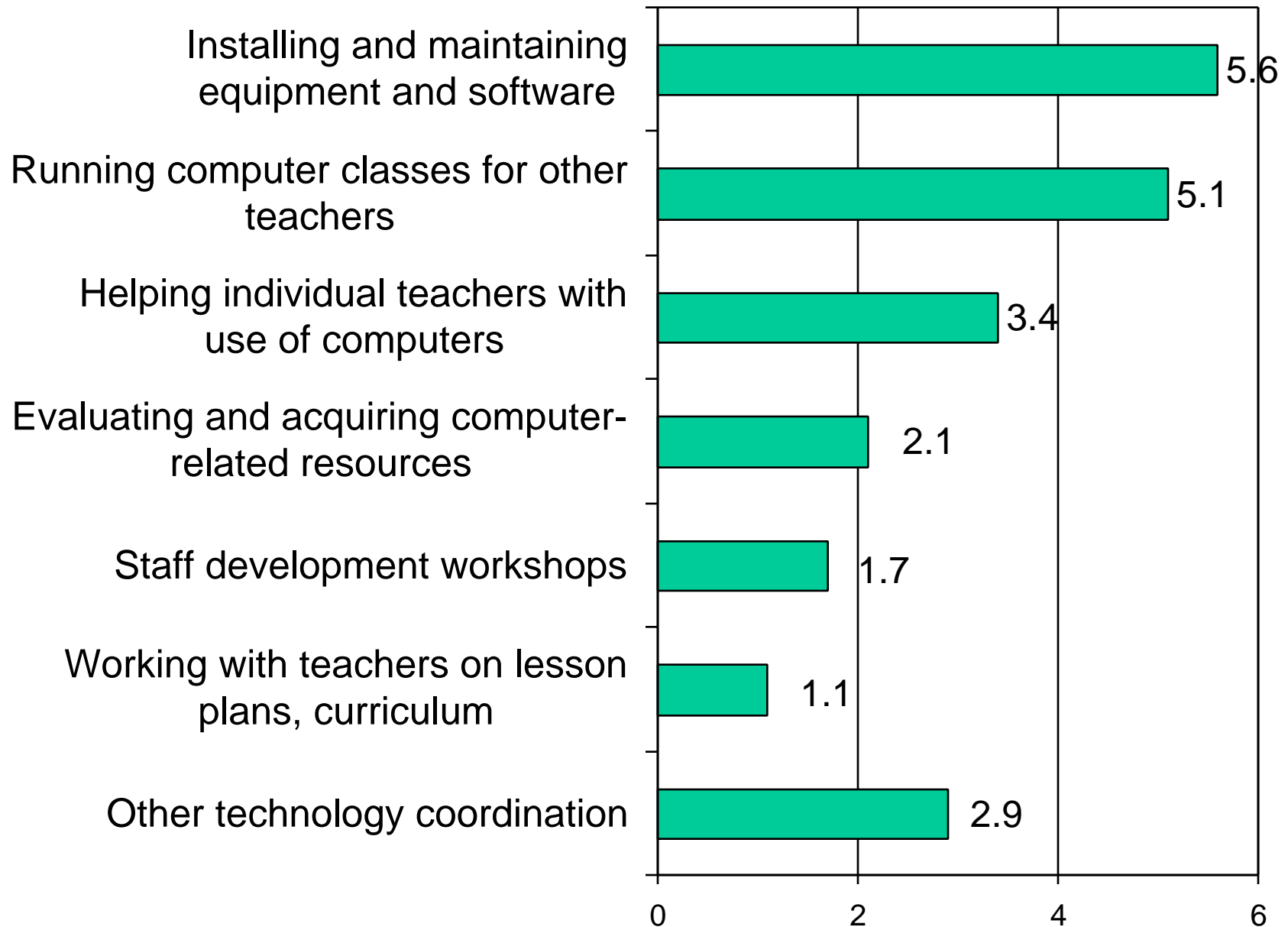
(Technology-Based Reform or High-End Tech Schools)

Spent More on Technology:

Average Per Student Spending, 1997-98



Investment in “Support” Based Upon Estimates of Weekly Hours Spent by Technology Coordinator



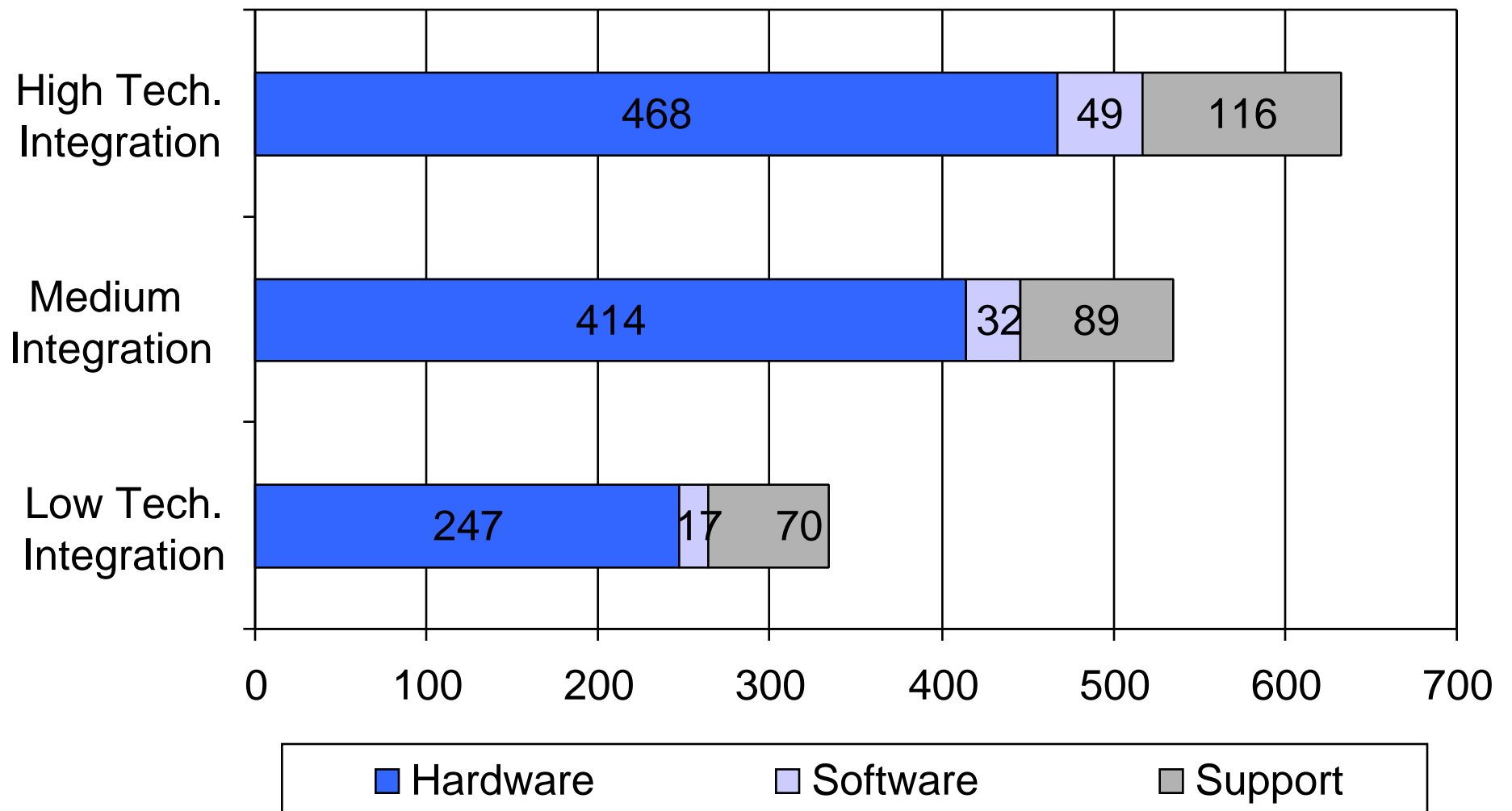
Measuring Technology Integration into Teaching Practices

Technology Coordinators were asked what proportion of the teachers did each of the following:

- Experiment with new teaching methods involving computers
- Use computers for their own professional tasks
- Sometimes have students use computers to do curricular assignments
- Involved in planning or implementing Internet-based activities
- See you for advice about integrating technology and curriculum

A summated scale was produced from these 5 responses. The schools were then divided into low, medium, and high groups, with the 25% least integrated in 'low', and the 25% most integrated in 'high'.

Technology Investments Have Been Higher in Schools With More Technology-Integrated Teaching Practices: Size of Current Infrastructure Per Capita by Level of Technology Integration



Constructivist Pedagogy Index

Deep Thinking

- Hold a debate and argue for a particular point of view which may not be their own.
- Represent the same idea in more than one way (in math by a table and a graph; in English, by a poem and an essay).
- Work on problems for which there is no obvious method of solution.
- Seriously assess their own work.
- Make conjectures about what they will learn or discover in a new unit.

Project-Based

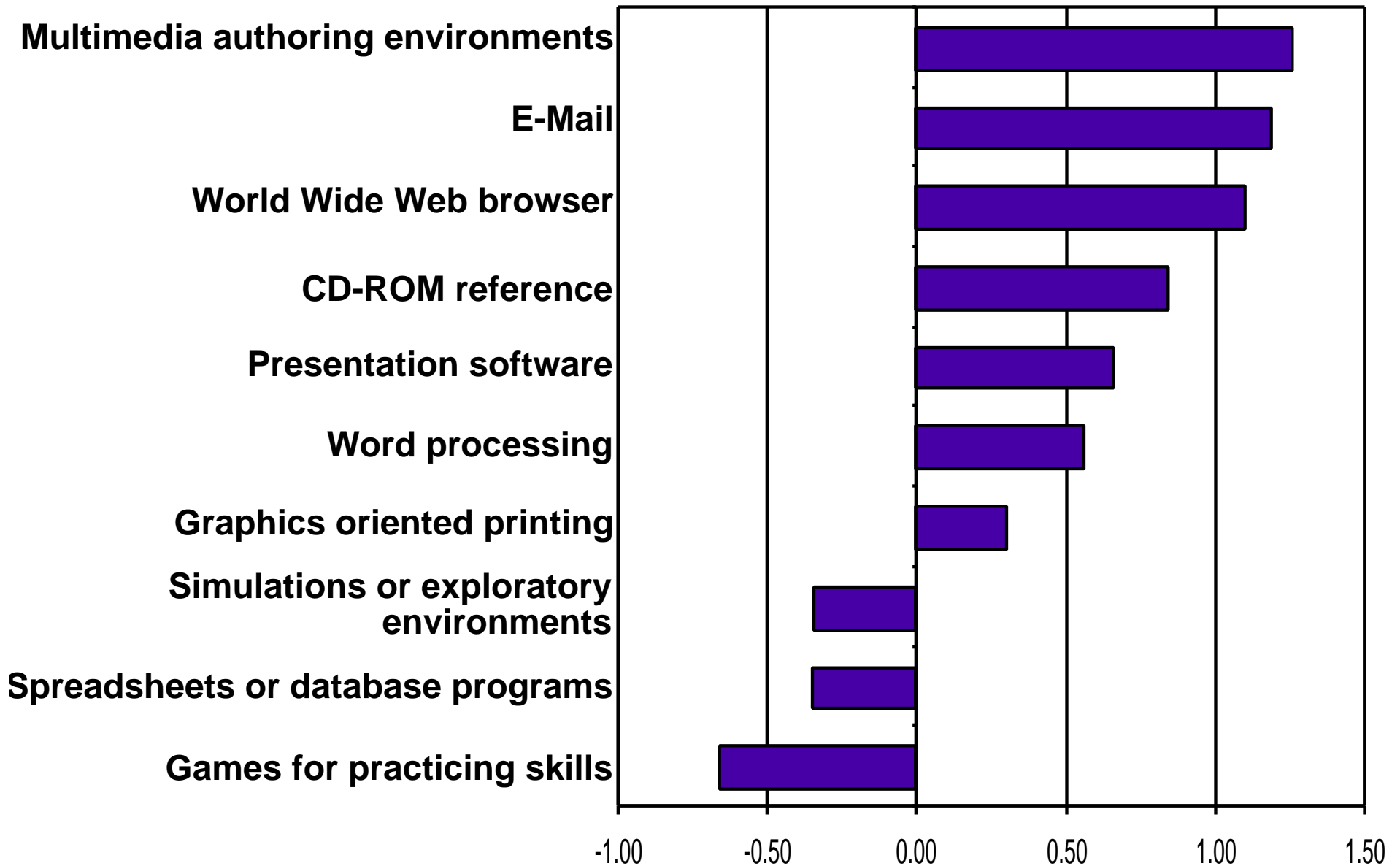
- Make a product that will be used by someone else.
- Do hands on/laboratory activities.
- Work on projects that take a week or more.
- Demonstrate their work to an audience including people other than from the school or their family.

Student-Designed

- Relate what they are working on to their own experience.
- Suggest or help plan classroom activities.
- Decide on their own procedures for solving a complex problem and then discuss among themselves their different procedures and results.

Which Software Is Linked with Constructivist Teaching?

(Constructivism of Computer Objectives of Major Users)



Changes in Pedagogy Over Previous Three Years

- Constructivist Direction

- More often have students teach or help other students.
- More often have students work on long projects.
- More often have students write a page or more on a single subject.
- More often evaluate students through their products instead of tests.
- More often allow myself to be taught by students.
- More often have many activities going on in the room at the same time.
- 5 others

- (Away from) Traditional Direction

- Have students answer questions in their textbooks.
- Closely monitor and supervise students while they work.
- Plan a lesson using principles of direct instruction.
- 2 others

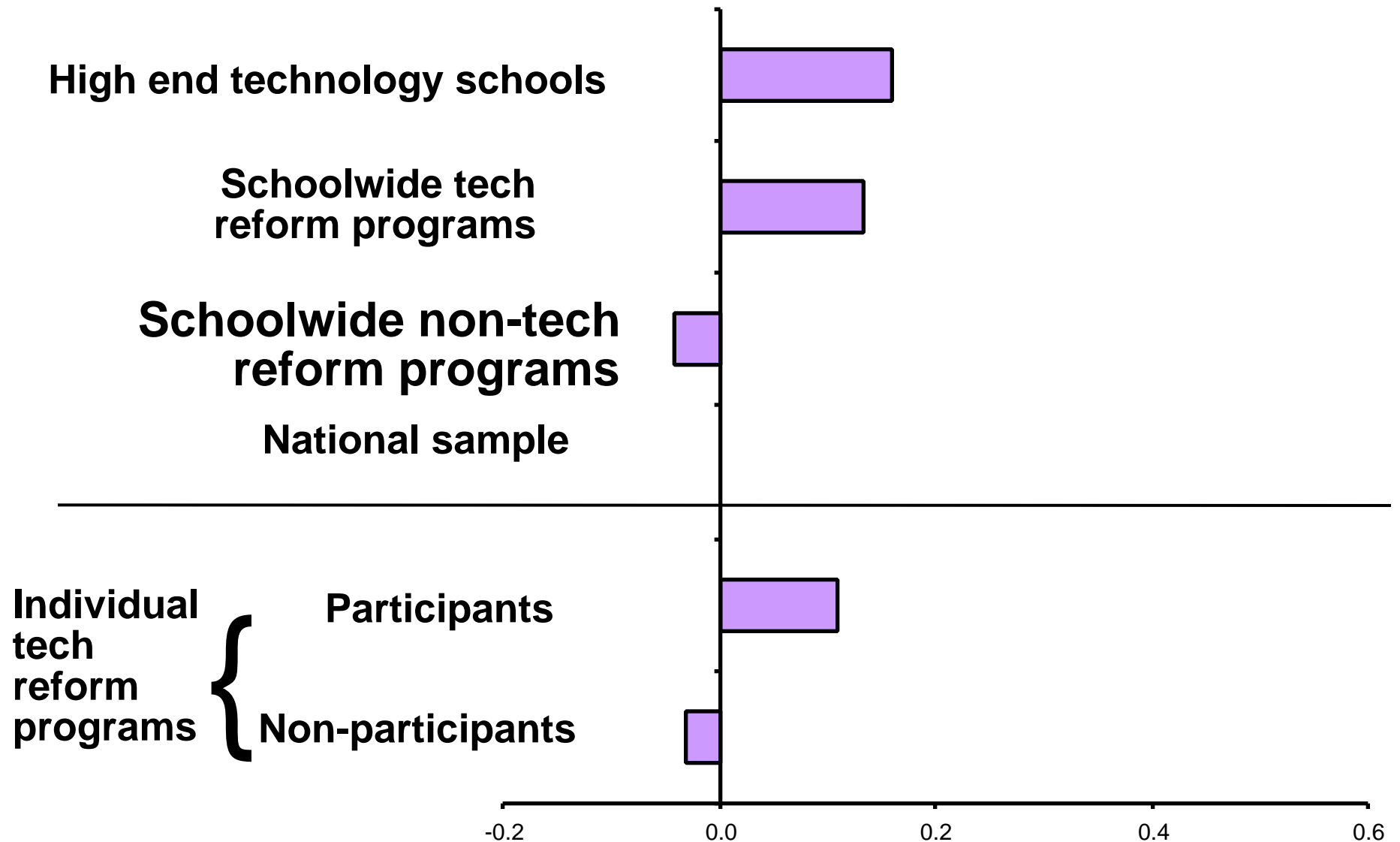
Which Teachers Report the Most Constructivist Pedagogical Change in their Own Practice?

- Users of a large variety of software
- Collaboration objectives for computer use
- “Written expression” objectives
- High computer expertise themselves (ex->ch?)
- Extensive use of World Wide Web

Structural and Personal Predictors of Constructivist Practice and Pedagogical Change

- Lots of technology available
- Schoolwide technology reform program present
- Teacher has a professional role orientation and personal involvement in reform programs
- Professional school culture exists

Constructivist Change in Teaching Compared to the National Sample



Correlations: Technology Investment & Teacher Learning

	Elementary				Secondary Academic			
	Hard ware Inve ntory	Soft ware Inve ntor	Supp ort	% \$ in Supp ort	Hard ware Inven tory	Soft ware Inve ntor y	Supp ort	% \$ in Supp ort
Prof. Develop. On Pedagogy					-.07			
Prof. Develop. On Content					-.09			
Prof. Develop. About Computers		+0.26				+0.13		
Internet use in teaching		+0.26				+0.14		
Student multimedia authoring		+0.21			-.09	+0.12		
Informal Discussion w/Other Tchr about Computers	-.14	+0.27		+0.11			+0.07	

Correlations: Technology Investment & Increased Computer Use

	Elementary				Secondary Academic			
Increasingly...	Hard ware Inve ntory	Soft ware Inve ntor	Supp ort	% \$ in Supp ort	Hard ware Inven tory	Soft ware Inve ntor y	Supp ort	% \$ in Supp ort
Trying out new software or technologies	-0.18	+0.36		+0.19			+0.07	
Using computers for class preparation	-0.14	+0.25		+0.24				
Assigning students to use computers		+0.34		+0.11		+0.08		
Suggesting students use computers in project work		+0.22		+0.10		+0.09		

Correlations: Technology Investment & Teacher Knowledge, Practice, and Changes in Practice

	Elementary				Secondary Academic			
	Hard ware	Soft ware	Sup port	% in Sup port	Hard ware	Soft ware	Supp ort	% in Sup port
Teacher Computer Knowledge, Skills & Professional Use		+.25		+.14	+.10			
Computer Skills	-.12	+.28		+.11	+.08			
Professional Uses	-.12	+.28		+.14	+.10			
Sophisticated Project Applications (L16)	-.12	+.16	+.13		+.11			
Constructivist Changes in Practice		+.15						
Computer Experiences Affected Changes Reported		+.19						+.08
Computers Affected Teaching Goals		+.15					+.10	

Correlations: Technology Investment & Teacher Software Use with Students

	Elementary				Secondary Academic			
	Hard ware	Soft ware	Sup port	% in Sup port	Hard ware	Soft ware	Supp ort	% in Supp ort
Freq. Student use, during class, of...								
Games for practicing skills		+.16				+.10		-.05
Simulations		+.20		+.11		+.10		
CD-ROM Reference sw	-.13	+.26						
Word processing	-.23	+.35		+.12	+.09			
Presentation software	-.11	+.29				+.08		+.05
Graphics printing		+.20						
Spreadsheets or database s.w.		+.13	+.09	+.09		+.15		
Multimedia authoring		+.18		+.12			+.08	
World Wide Web		+.25		+.10		+.11		-.06
Electronic mail	+.13						+.05	-.05

Teacher's Work Role Orientation: Professional Leadership vs. Classroom Focus

1. Teacher Professional Contacts at School:

**Discussions of Teaching, Learning, Subject-matter, technology
Classroom Visits to Observe Teaching**

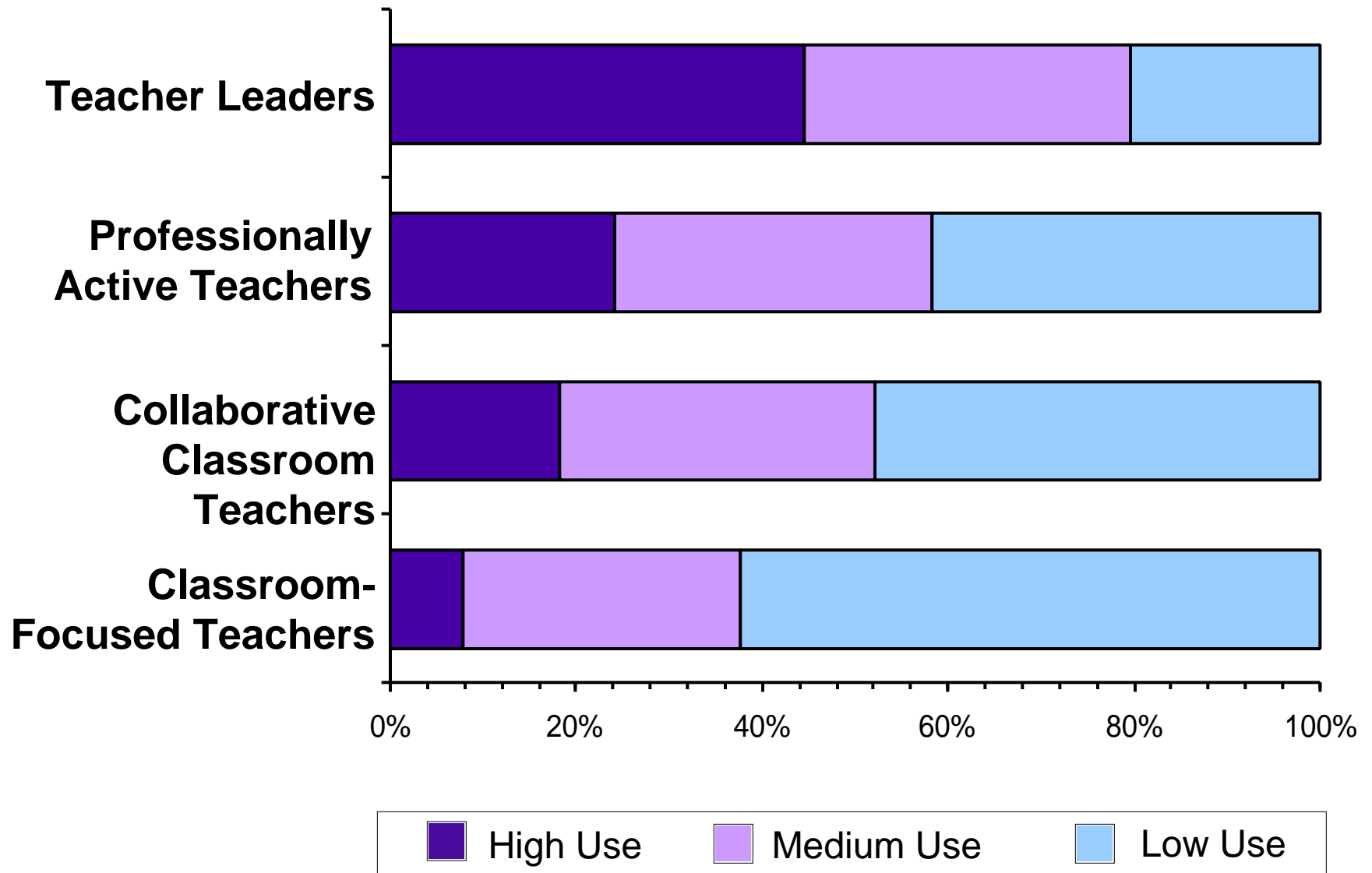
2. Teacher Interactions Beyond the School:

**Attends Workshops
Participates on Committees
Professional exchanges through E-mail**

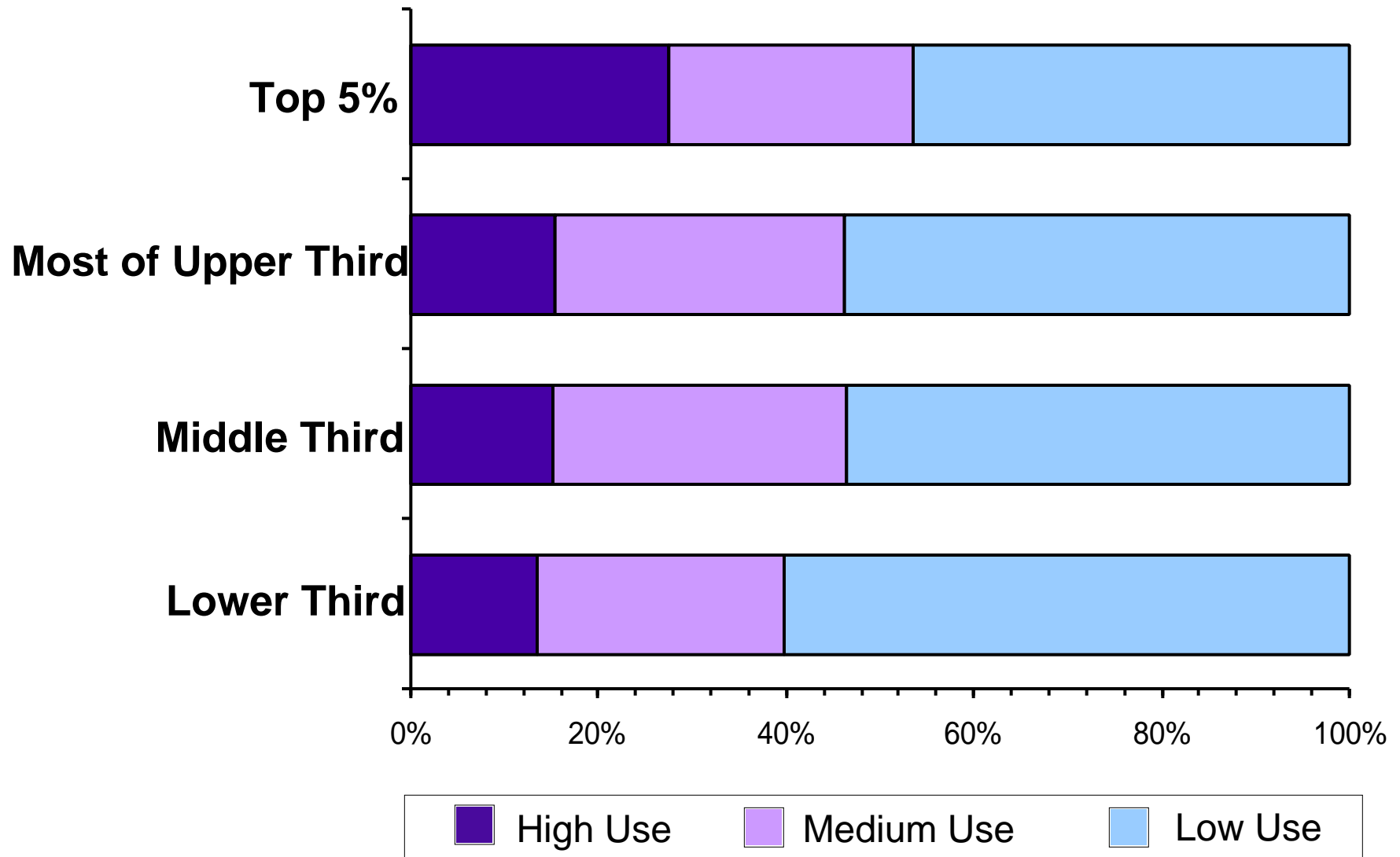
3. Leadership Activities over Past 3 Years:

**Mentoring
Teaching Peers in Workshops/Conferences
College Teaching
Publishing Articles for Practitioners**

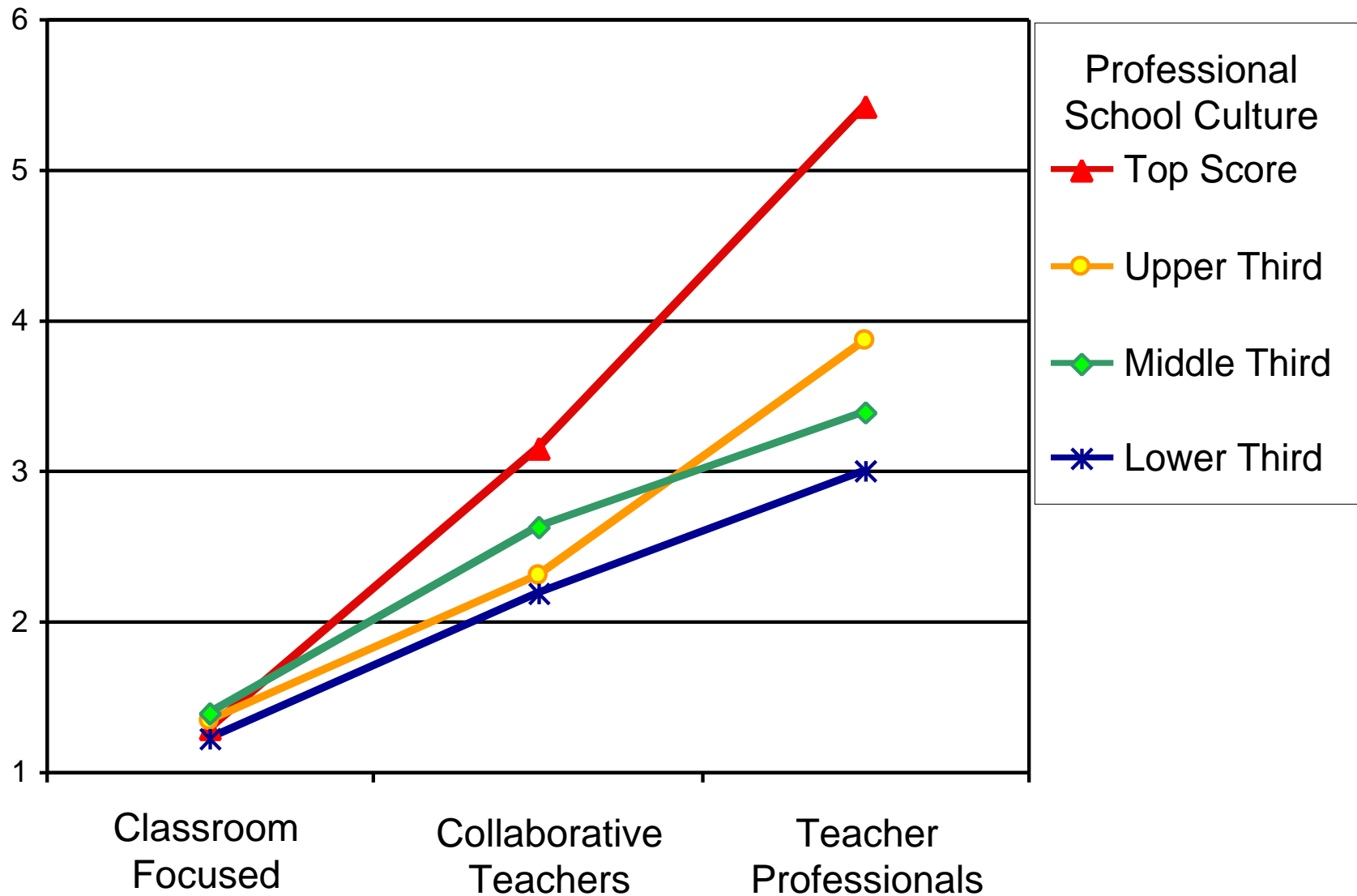
Extent and Variety of Constructivist Computer Use by Teacher Role Orientation



Extent and Variety of Constructivist Computer Use by School Work Culture



Use of World Wide Web Browser, by Role Orientation, by School Culture (Selected Subjects)



Conclusions from TLC Data

- **Using computers leads to more constructivist practice**
 - Allows the constructivism in most teachers to emerge
- **Schoolwide high-tech presence and tech-based reform leads to more constructivist practice**
- **Professionally oriented teachers and professional school cultures**
 - Are more constructivist in philosophy and practice
 - Use computers in more constructivist ways
- **Broad distribution of diverse software and high proportion of tech investment going to support are keys to an effective technology program.**

Information Available on TLC Web Site

- **Main Report Series** (first 3 of 12 available now)
 - *Internet Use by Teachers*
 - *Computer Presence in American Schools*
 - *Teacher and Teacher-Directed Student Use of Computers & Software*
- **Special Reports**
 - *Teacher Professionalism, School Work Culture, and the Emergence of Constructivist-Compatible Pedagogies*
 - *Computer Use and Pedagogy in Co-NECT Schools, A Comparative Study*
- **Snapshots (selected)**
 - *Contrasting Philosophies among American Teachers*
 - *Software Use in Classes of Different Levels of Student "Ability"*
 - *Subject and Teacher Objectives for Computer-Using Classes by School Socio-Economic Status*
 - *Teacher Pedagogical Differences by Computer Platform*

For More Information visit our Research Project Web Site:

www.crito.uci.edu/TLC

- New findings presented *weekly* as often as we can
- Discussion group
- Reports and newsletters: view or download
- Archive of previous newsletters and findings