Technology Use and Educational Reform: Where does a relationship exist?

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TEACHING, LEARNING & COMPUTING 1998

www.crito.uci.edu/TLC

TLC Project: Purpose

To investigate the conditions under which teachers' use of computers changes teaching practice consistent with instructional reform theories.

Model of Instructional Reform I:
Emphasize Teaching for Understanding

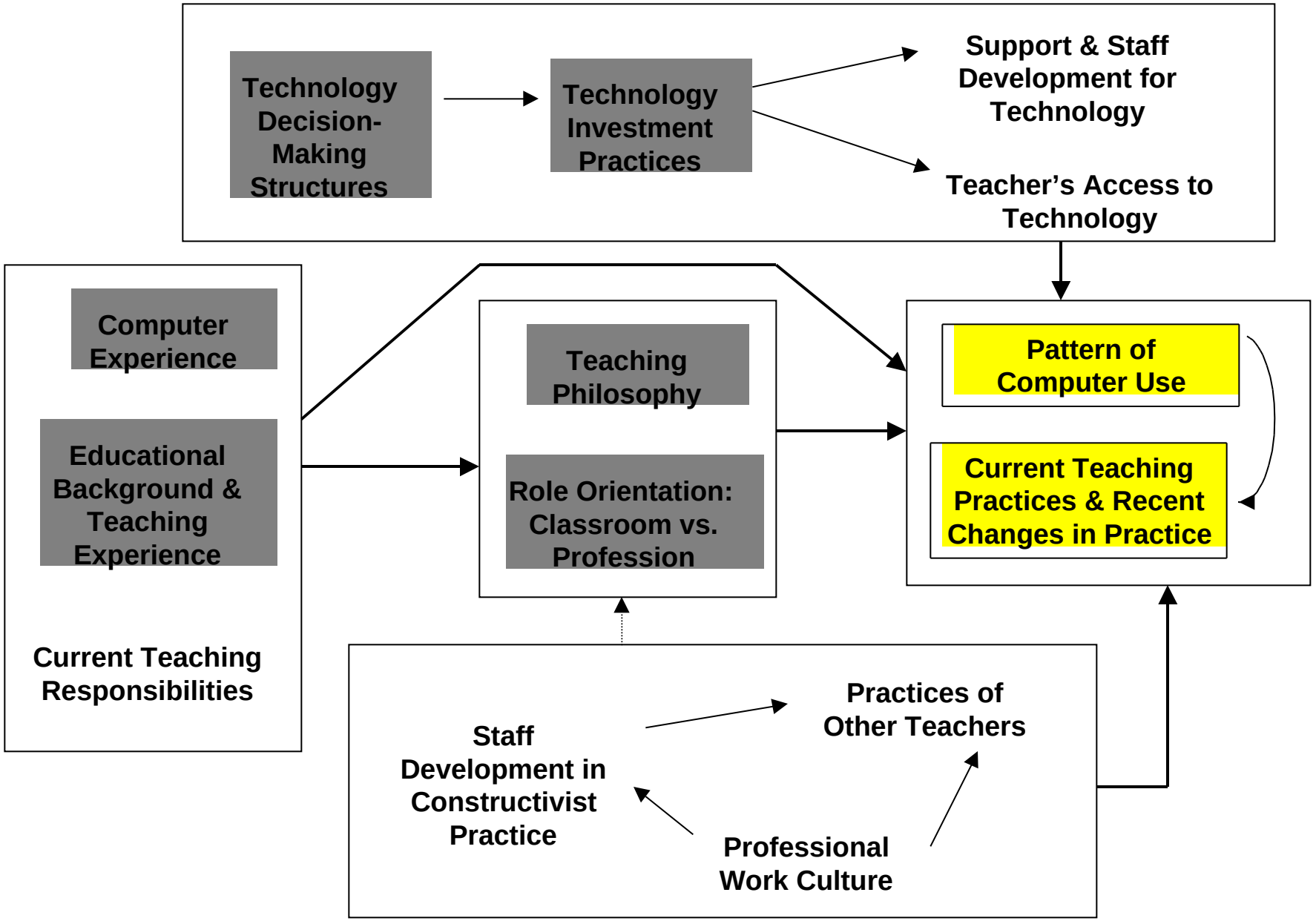
- Focus on challenging objectives...
- And equally challenging tasks…
  - Students articulate reasoning (e.g., writing)
  - Revise their work
  - Peer discourse and group decision-making
  - Meta-cognition
- Made feasible by...
  - Resources: information, “thinking tools,” communication
  - Reorganizing classroom structures and roles
    - Model the learning process
    - Student responsibility and freedom
  - Meaningful tasks
- Assessment consistent with learning goals

Model of Instructional Reform II

Make Meaningfulness The Primary Attribute of Tasks

- Contextually rich learning tasks
  - Projects
  - Real world applications
  - Authenticity
  - Depth
  - Skill learning embedded
- Take students' thinking and feeling into account
  - Students' prior beliefs
  - Student interest -> tasks
  - Student choice in tasks and methods
- Reorganize classroom structures and roles
  - Cooperative work groups
  - Students given leadership roles
  - Student initiative facilitated

Model of Effects on Computer Use Practices and General Pedagogy



The School Sample in TLC

- A representative sample of all U.S. schools, public and private (Probability Sample: 655 schools participated)

- 378 schools from more than 50 major reform projects
- 182 schools with high-end technology (Purposive Sample)

- Three-quarters of sampled schools participated in the study

- National school-level estimates from Probability Sample:
  488 principals and 467 school technology coordinators, each in 65 to 70% of the participating schools

The Teacher Sample in TLC

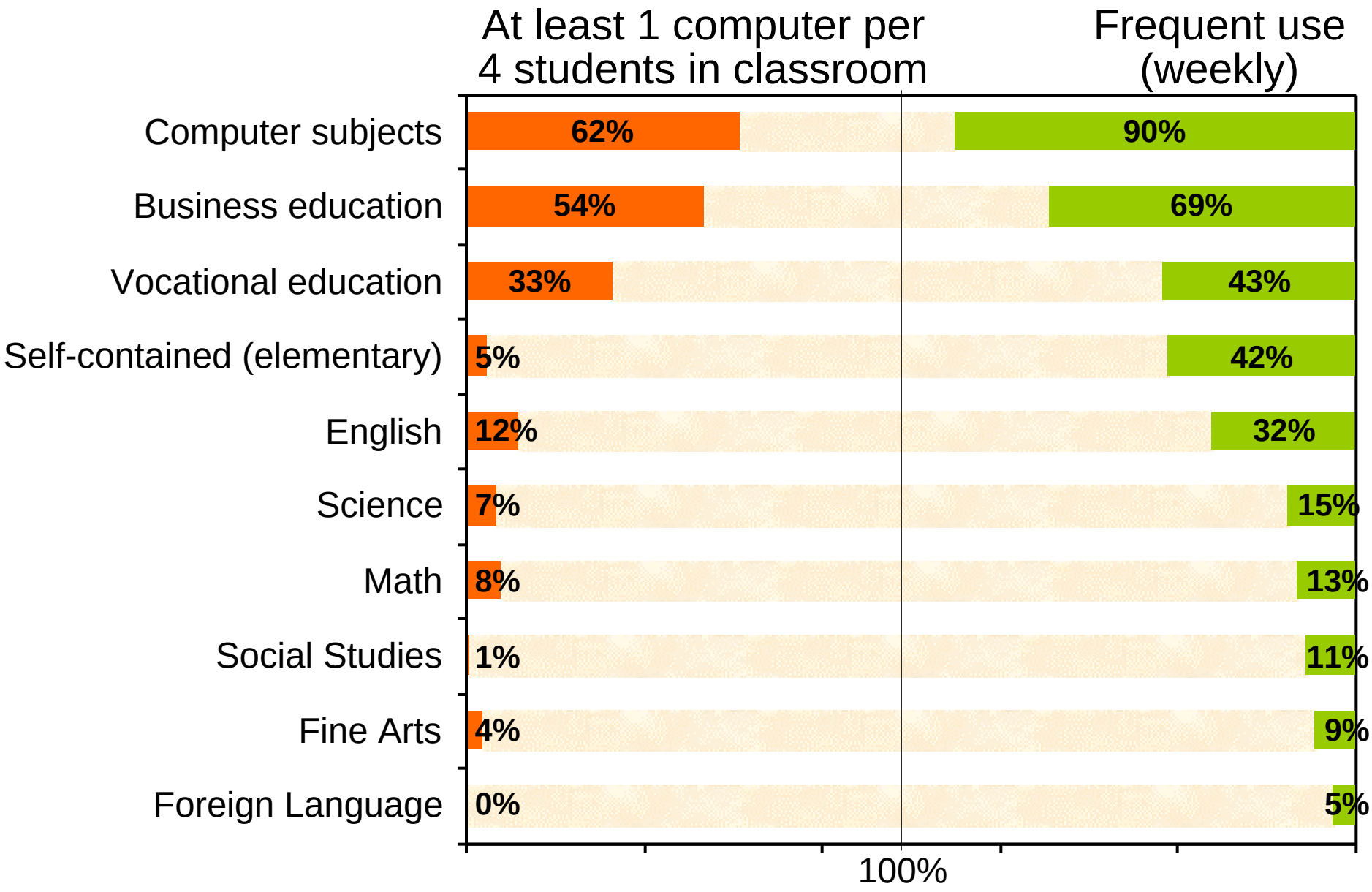
- Over 4,100 teachers from grades 4-12 participated, nearly 70% of those sampled
  - Completed 20 page questionnaires
  - Four different versions; heavily overlapping questions

- 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

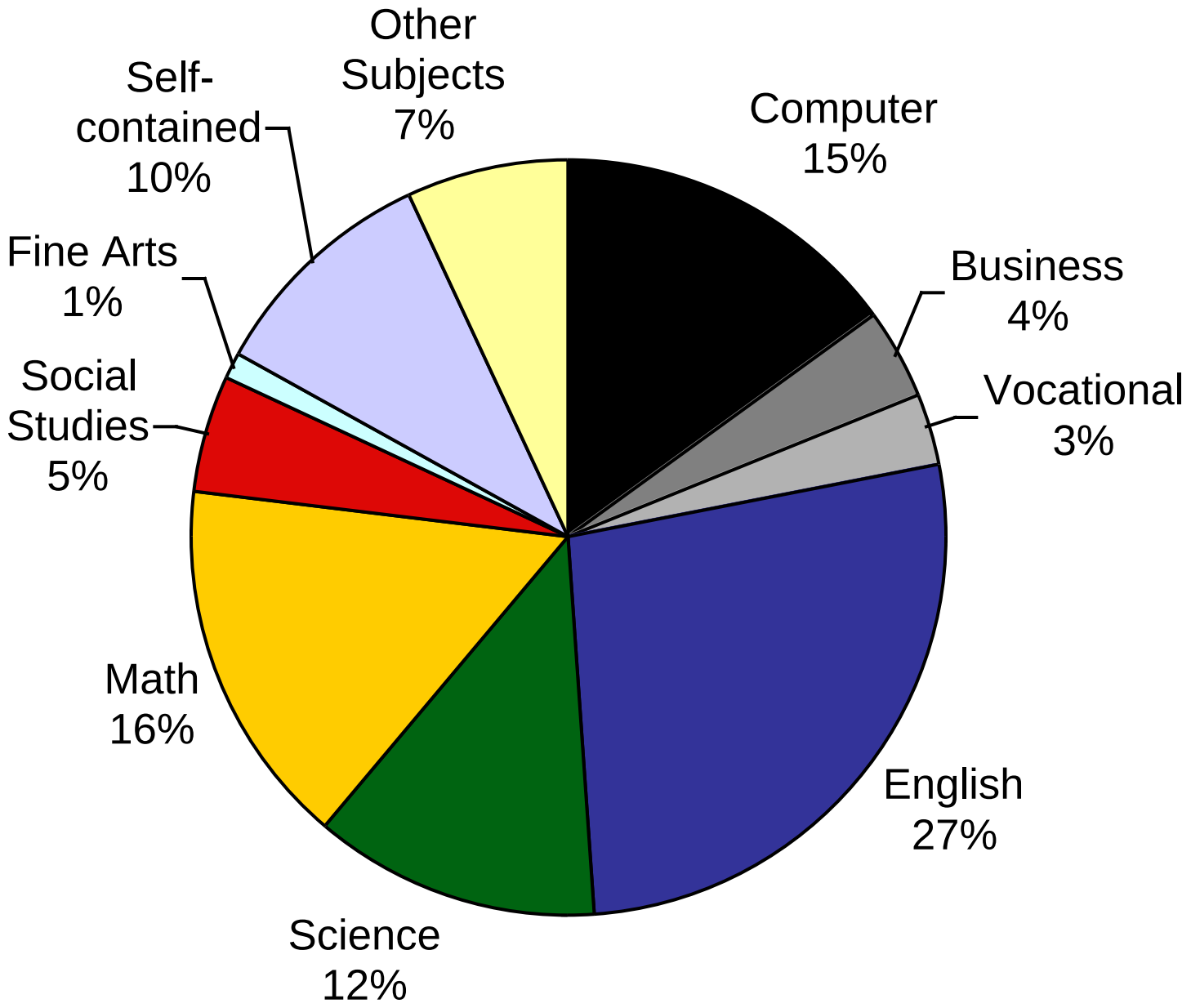
- Parts of this presentation use data only from the Probability Sample: 2,251 teachers

What is the extent of computer presence and use in U.S. Schools?

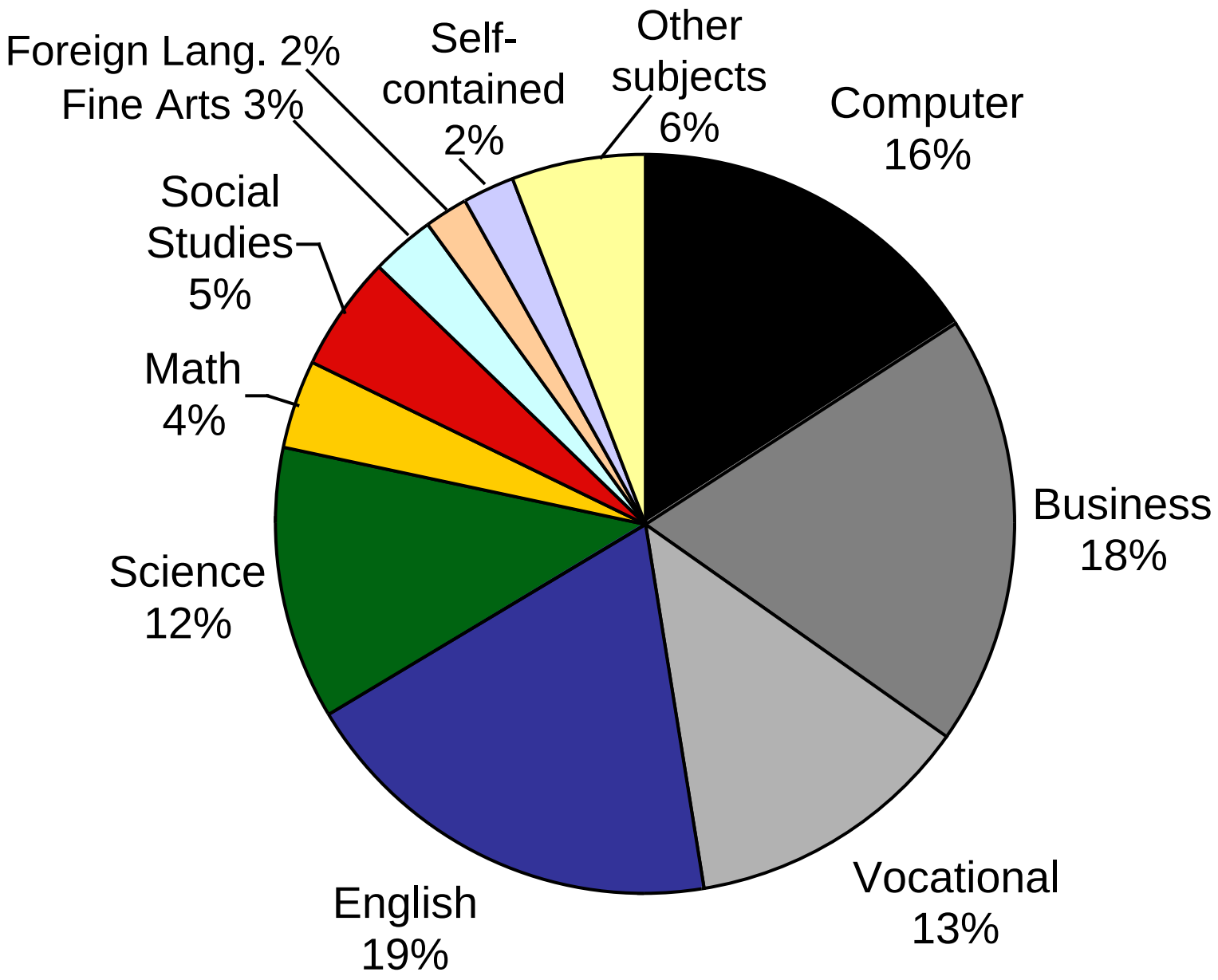
Classroom Access and Use by Subject Taught



All Teachers Who Use Computers Frequently With Students in Middle School



All Teachers Who Use Computers Frequently With Students in High School



Technology's Role in Constructivist Reform

Philosophy Index

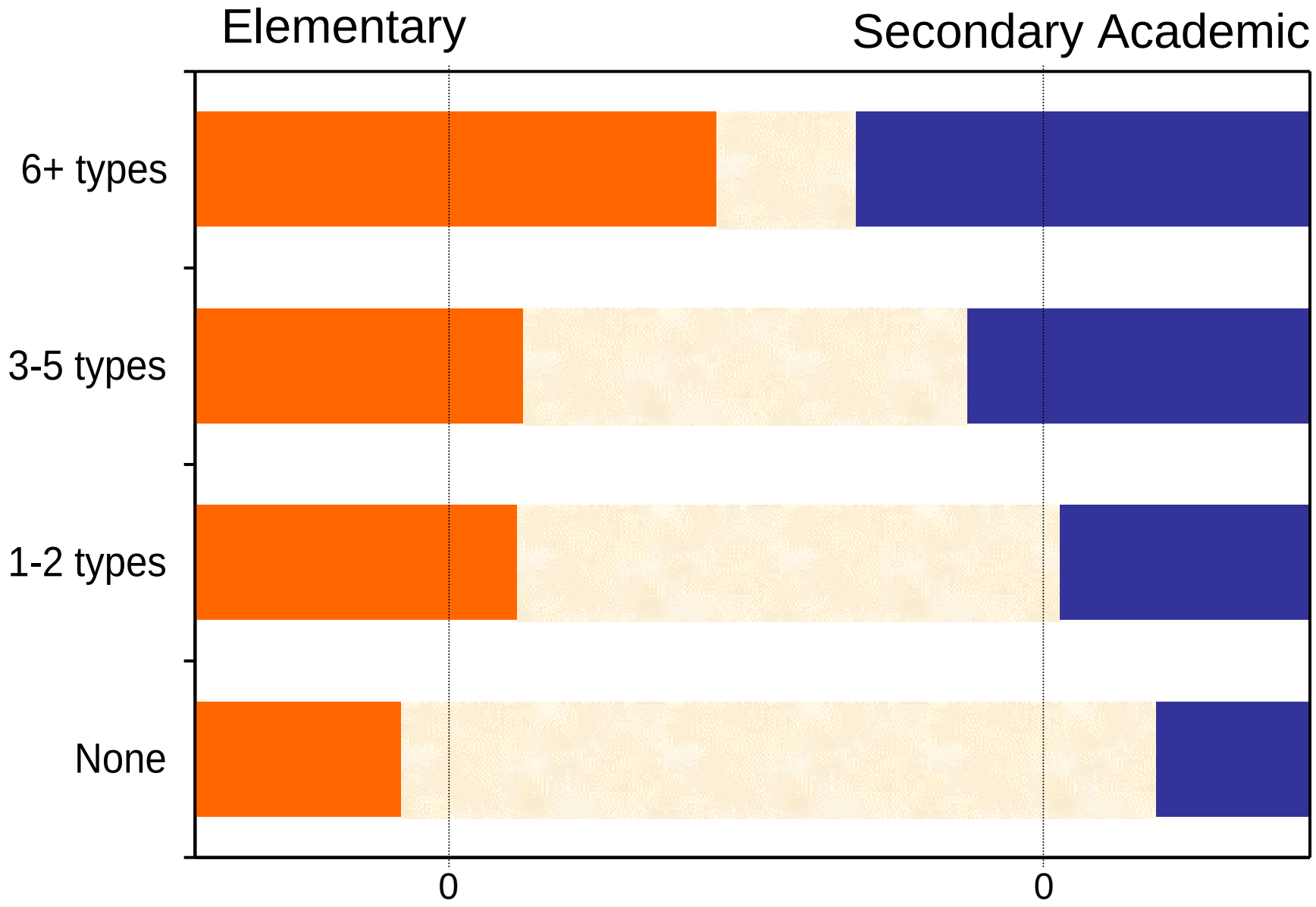
Constructivist Philosophy

- Knowledge is built through class and group discussions
- Students need to find answers to their own questions and problems
- Students construct concepts for themselves
- “Sense-making” and guided inquiry
- Authentic, integrated tasks
- Diverse classroom projects

Traditional Philosophy

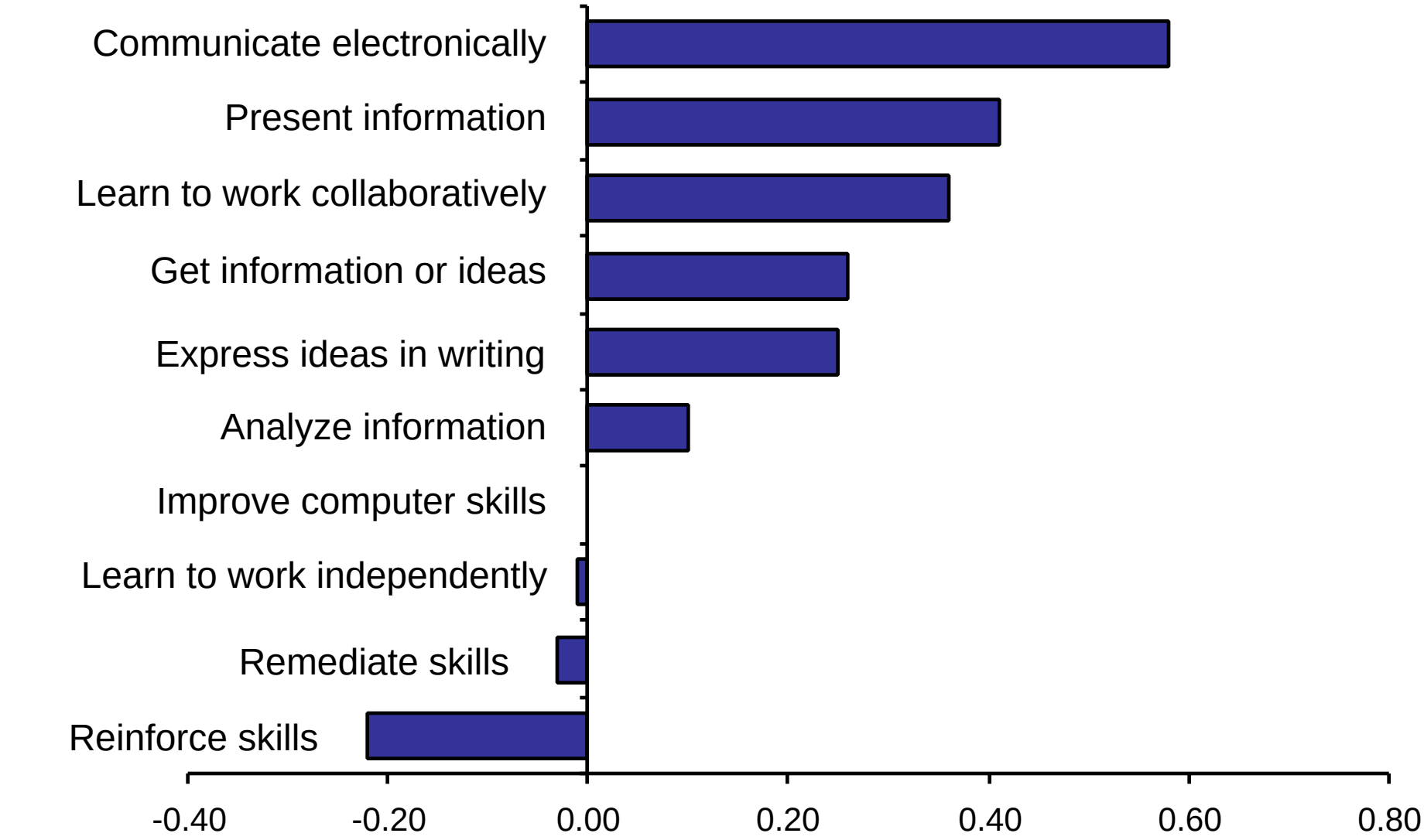
- Teachers describe and explain concepts, and students learn this content
- A quiet classroom is important for learning
- Acquiring basic content knowledge and skill primary
- Teacher - not students - determine activities
- Instruction is built around problems with clear, easily found, correct answers
- Teaching facts and skills provides the foundation for later learning

Constructivist Philosophy by Variety of Software Used



Constructivist Philosophy by Major Objectives for Computer Use

(computer-using teachers)

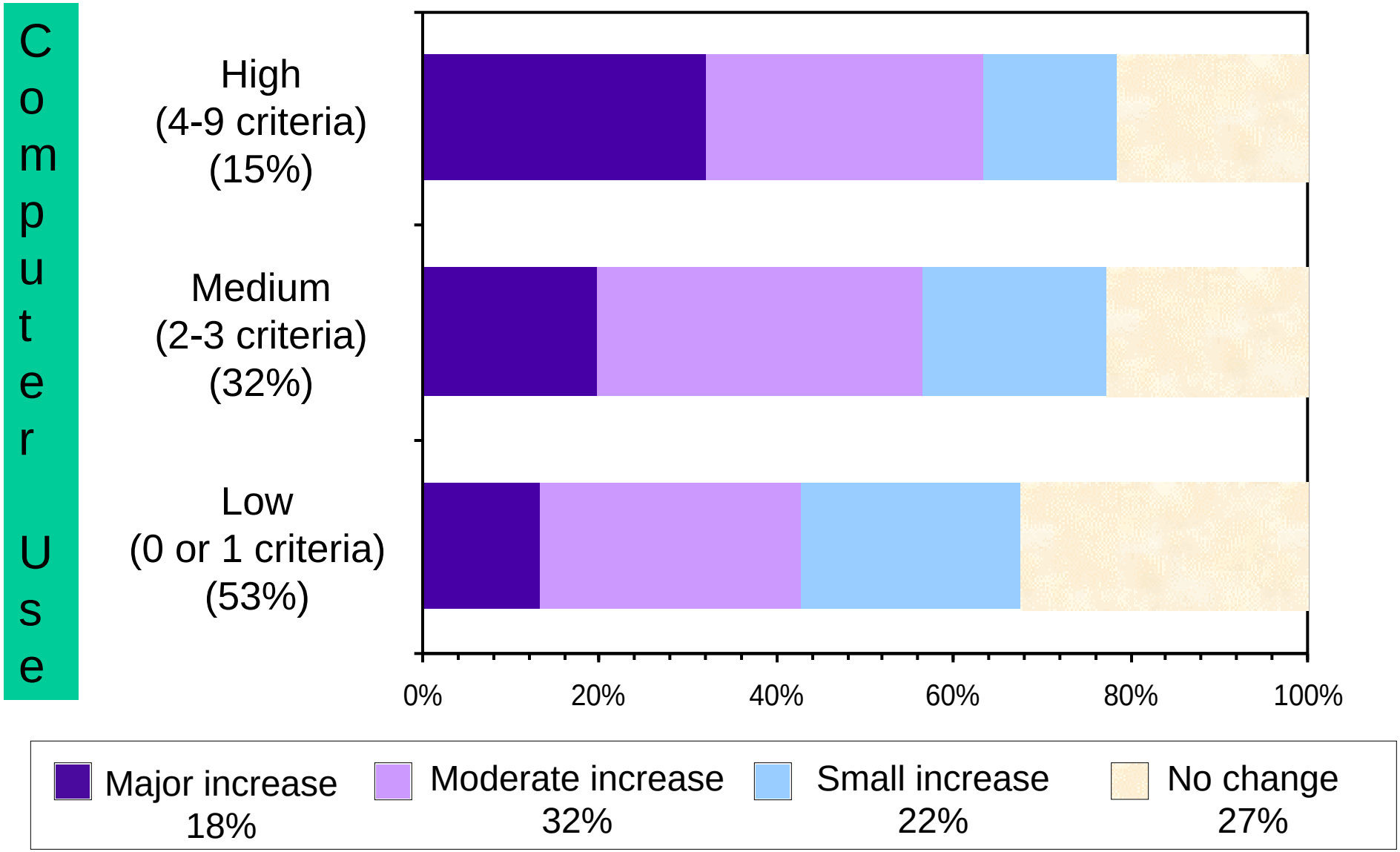


Changes in Pedagogy Over Previous Three Years

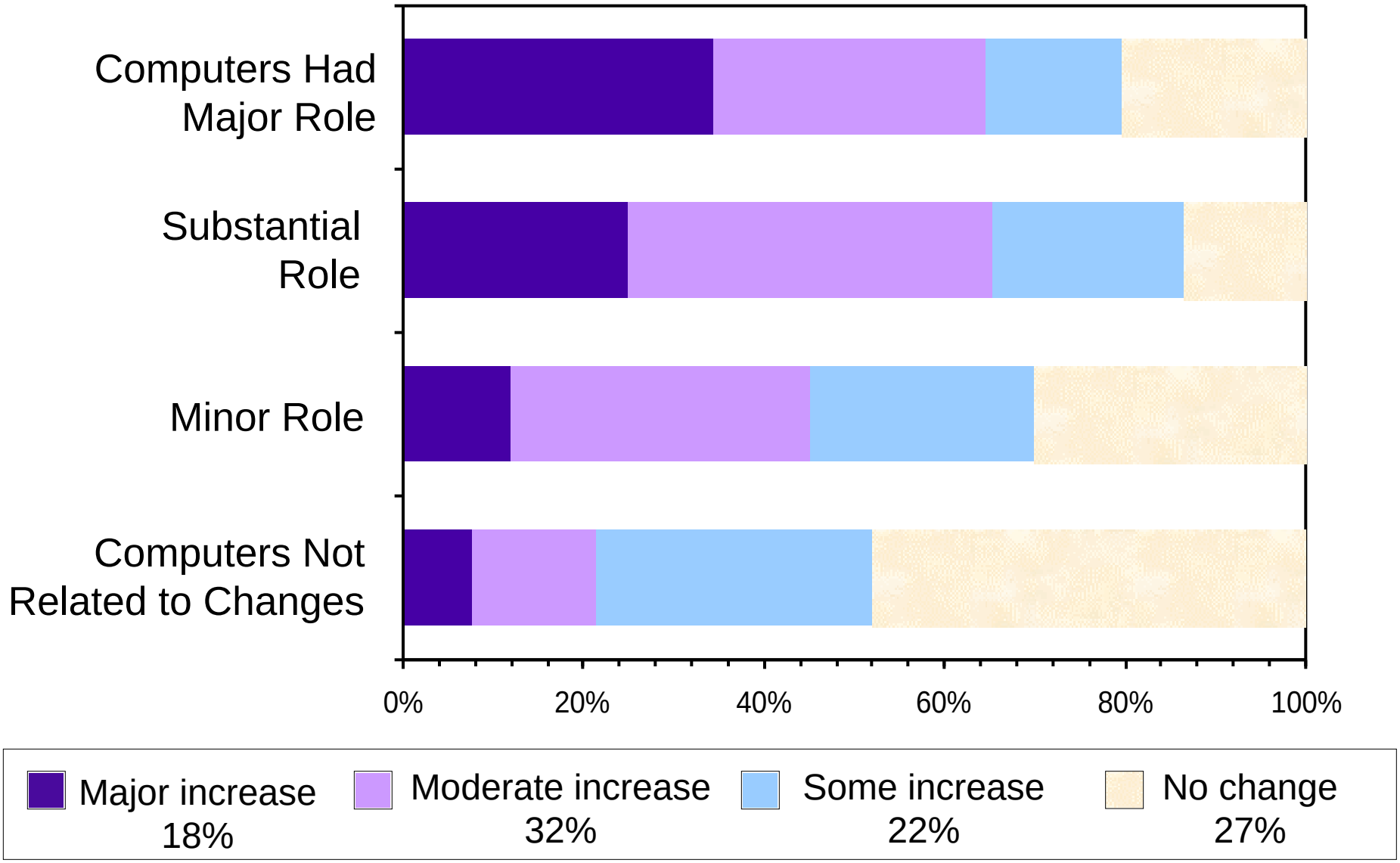
- Constructivist Direction
- More often have students teach or help other students.
- More often have students work on long projects.
- More often have students write a page or more on a single subject.
- More often evaluate students through their products instead of tests.
- More often allow myself 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

Increase in Constructivist Practice by Extent and Variety of Constructivist Computer Use

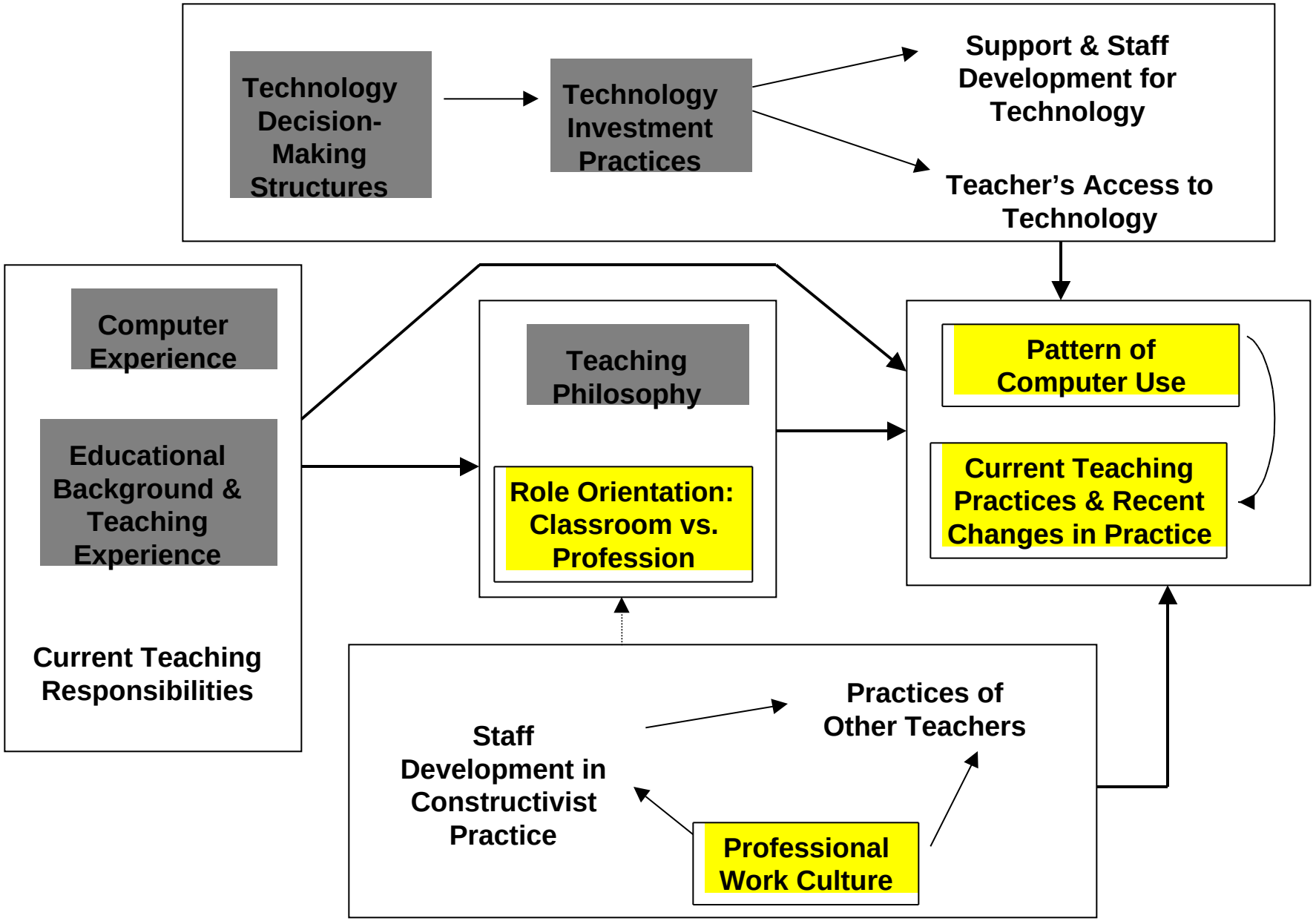
(among computer-using teachers)



Increase in Constructivist Practice by Teacher-Perceived Impact of Computers on Their Change in Practice



Model of Effects on Computer Use Practices and General Pedagogy



Teacher's Role Orientation: Professional vs. Classroom Focus

1. Teacher Professional Contacts at School:

   Visit Other Teacher Classrooms
   Discuss Issues of Teaching, Learning, Subject-matter, Technology

2. Outside of school:

   Attends Workshops
   Participates on Committees
   Professional exchanges through E-mail

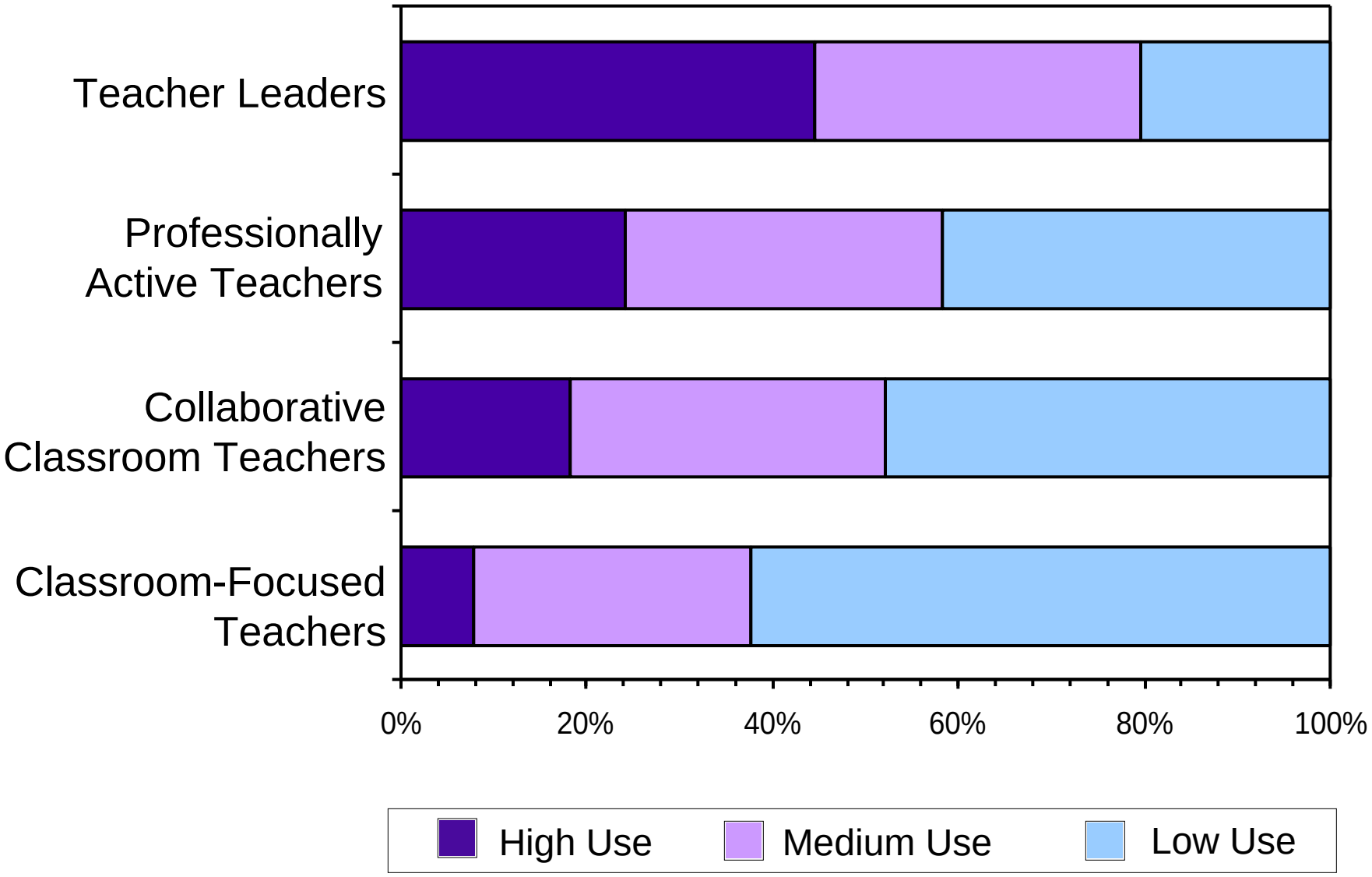
3. Leadership Activities:

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

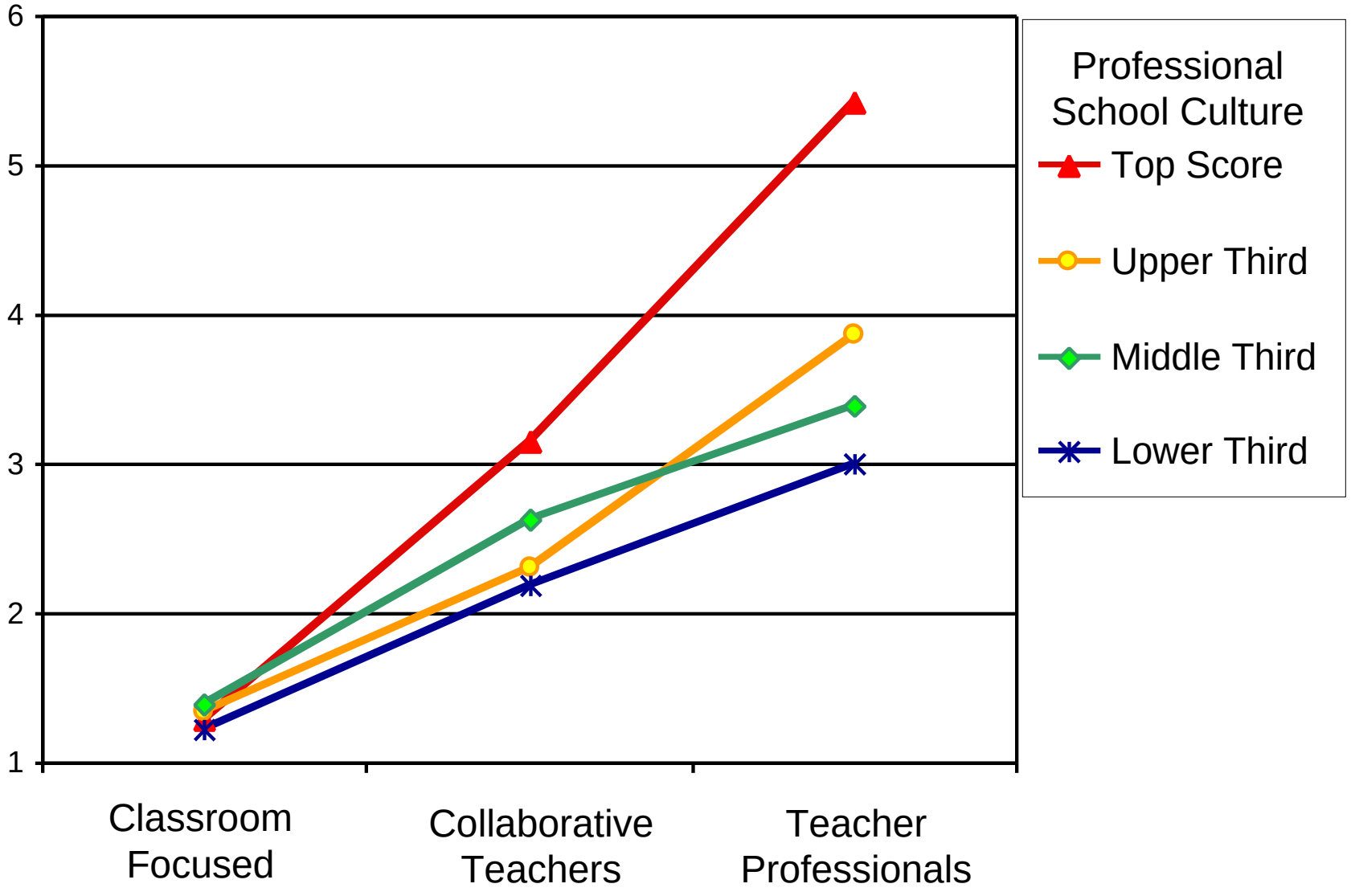
Professional School Culture

- Teachers share samples of student work
- Recognition for good teaching innovation
- New ideas encouraged
- Pressure for good teaching
- Staff development ideas discussed afterwards and supported
- Teachers and principals share goals

Extent and Variety of Constructivist Computer Use by Teacher Role Orientation



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



Technology's Effect on Constructivist Practices Overall and by Subject

Meaningfulness of Learning Activities

Group Work	Projects	Problem Solving
• Discuss topic in groups when unit introduced •Small groups to complete assignment as team •Small groups come up with a joint solution or approach to a problem or task	• Work on projects that take a week or more. • Do hands on/ laboratory activities. •Make a product that will be used by someone else. • Demonstrate work to people other than from the school or their family.	• Work on problems for which there was no obvious method of solution •Design their own problems to solve •Decide own procedures for complex problem and discuss results

Teaching For Understanding Activities

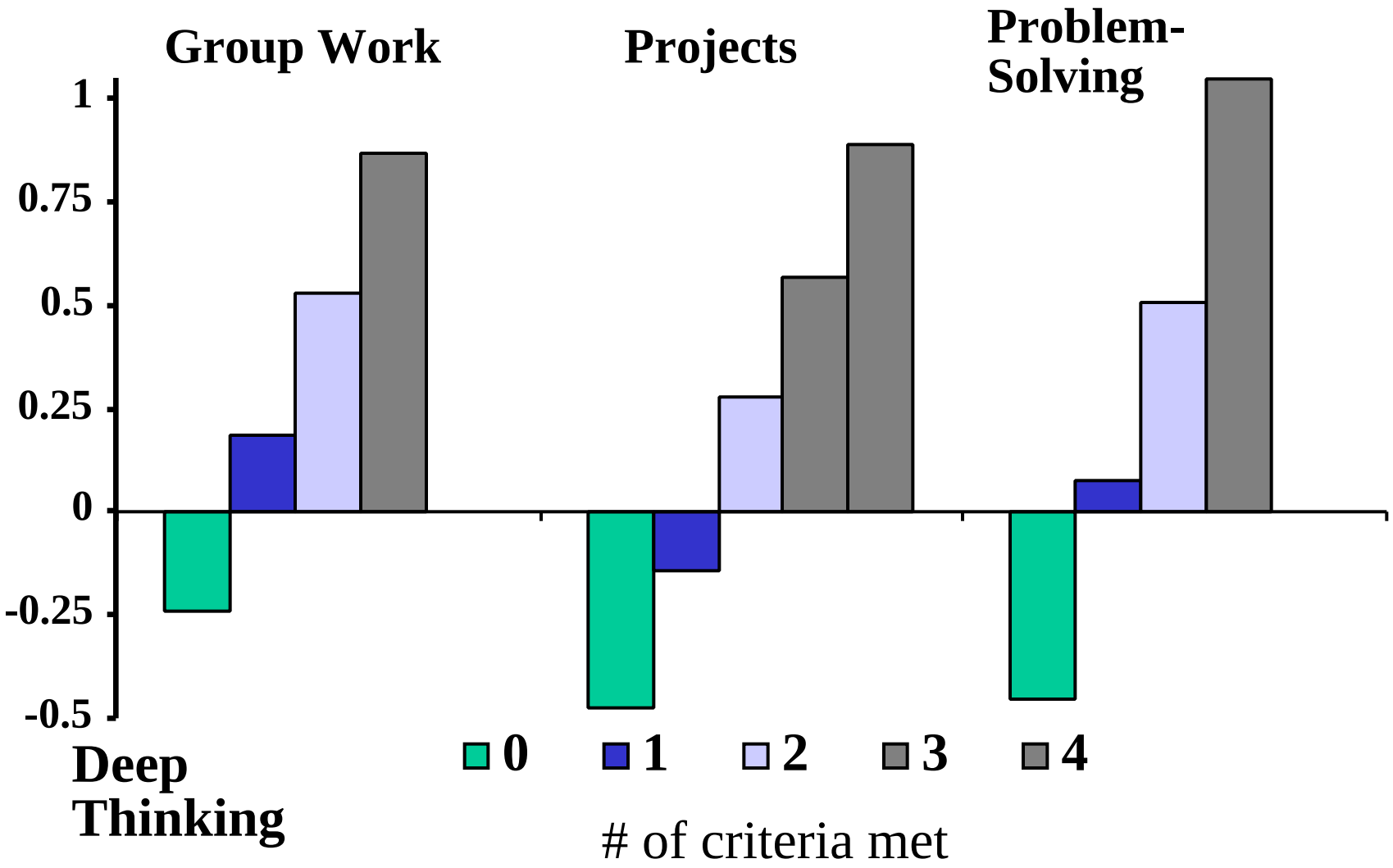
Reflective Writing

- Students write in a journal
- Students write an essay explaining their thoughts in depth
- Students write an essay seriously assessing their work.

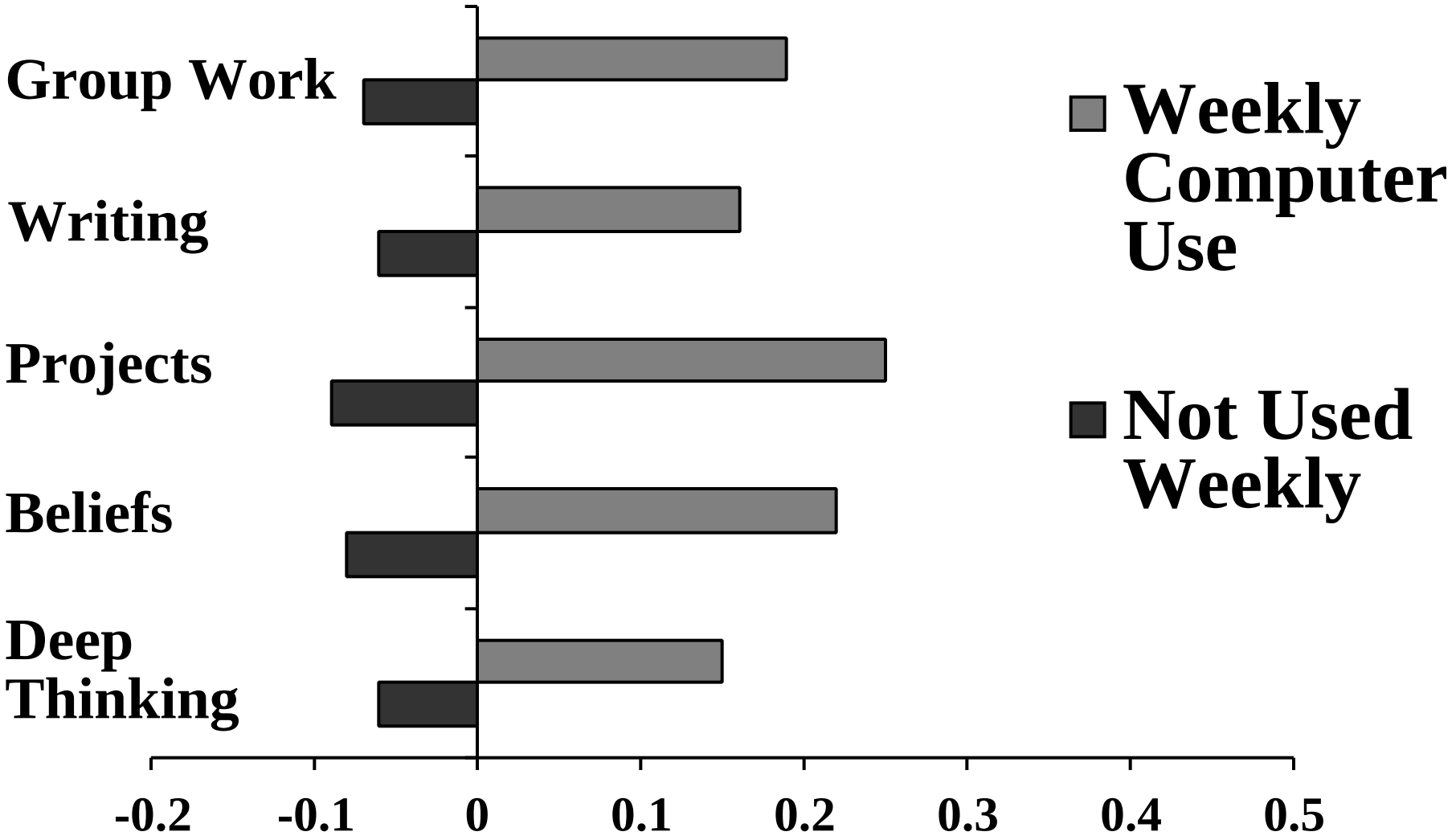
Divergent Thinking

- Students make conjectures
- Teachers raises unanswered questions
- Students lead class discussion & help plan activities
- Teacher elicits student ideas & opinions
- Students asked to justify/explain reasoning
- Students relate work to their own experiences
- Students debate points of view not their own
- Represent same idea multiple points of view
- Tasks with no “correct” answer

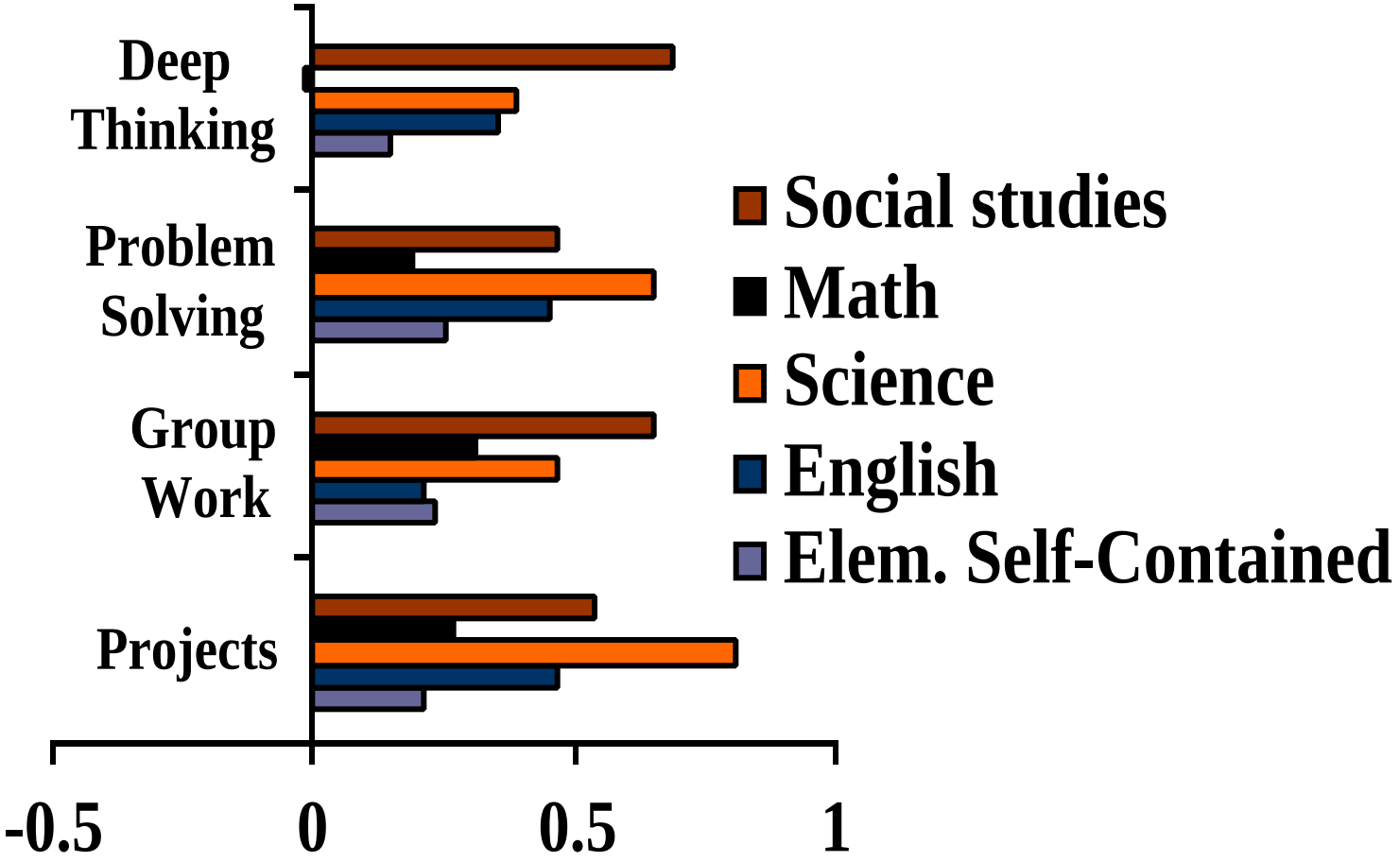
Group Work, Projects and Problem-Solving indices related to Deep Thinking, shown by # of Criteria met



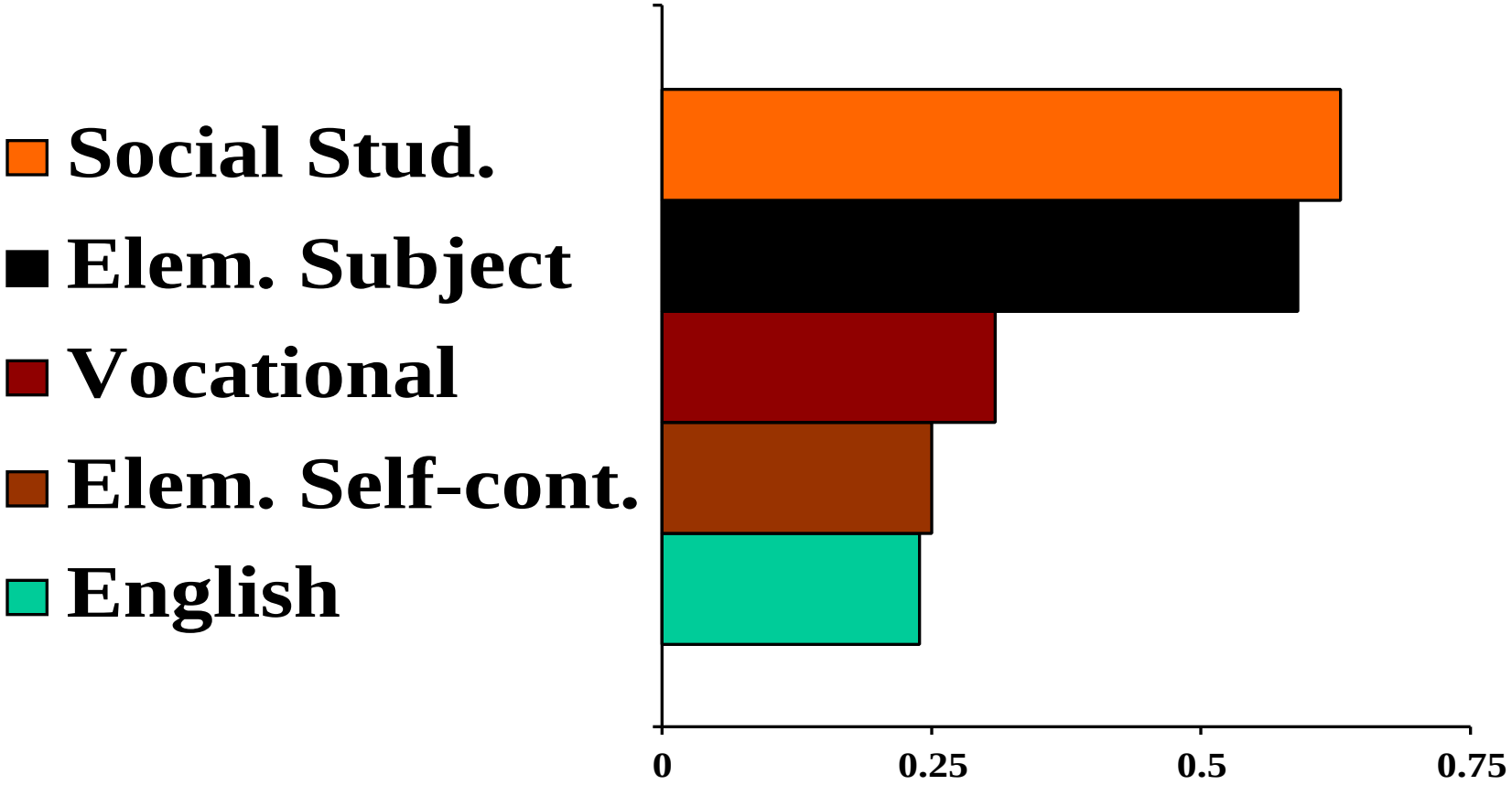
Across ALL SUBJECTS, teachers who assign computers weekly score higher on practice measures



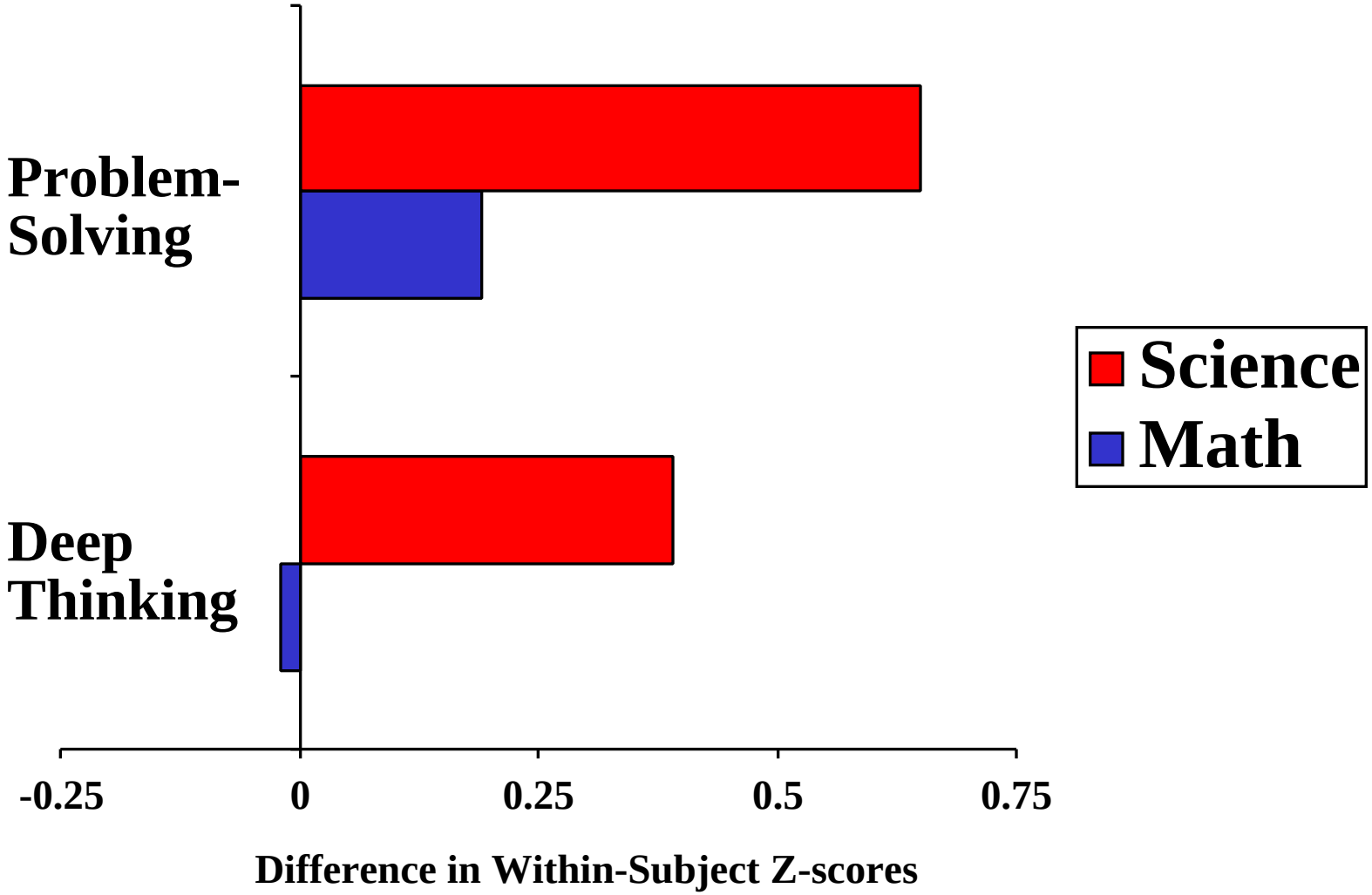
Weekly Student Computer Use and Constructivist Practice, by Subject



REFLECTIVE WRITING: Effect sizes for Weekly Computer Use in Selected Subjects

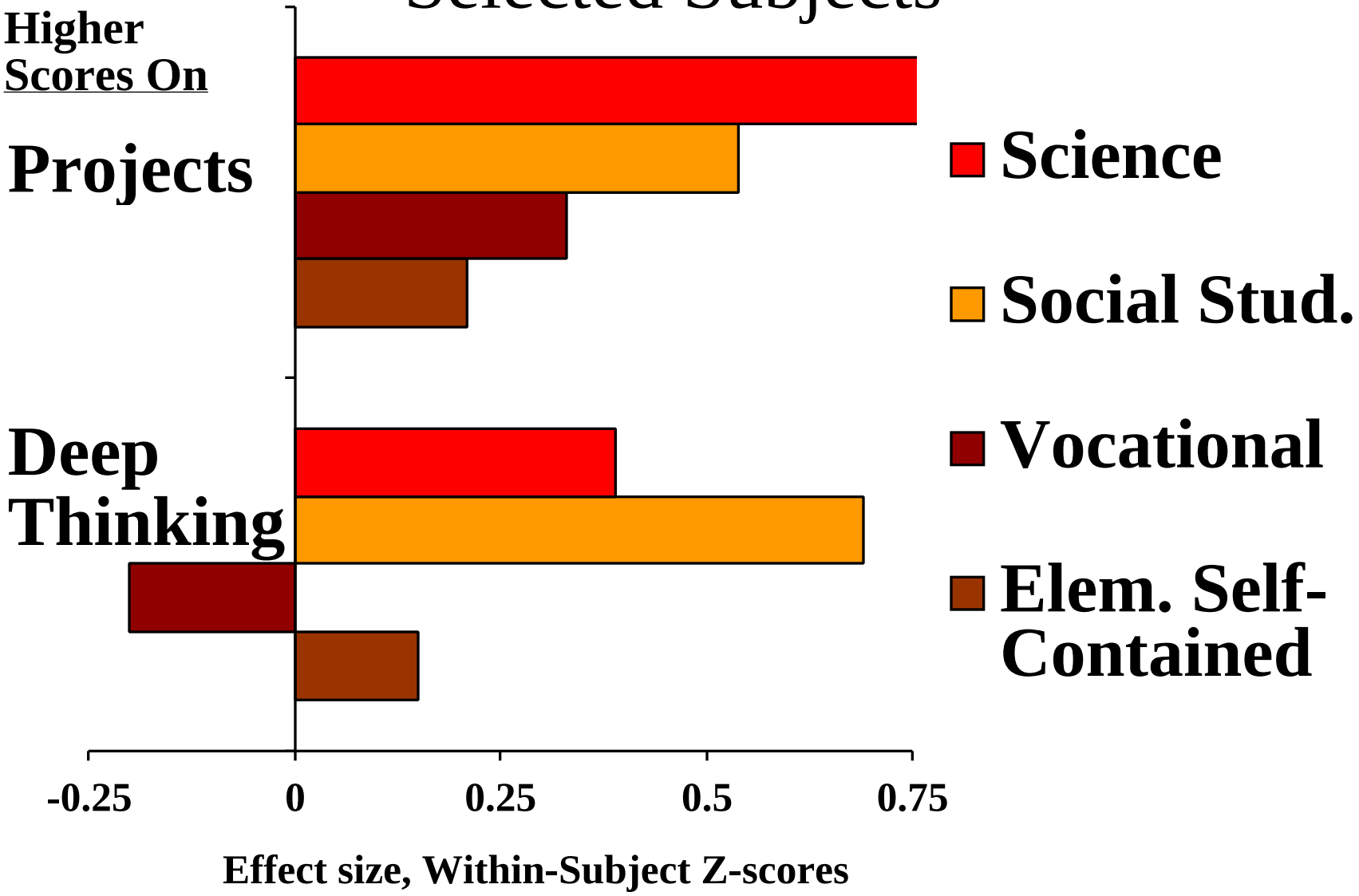


PROBLEM-SOLVING & DEEP THINKING : Effect Size of Weekly Student Computer Use in Science and Math



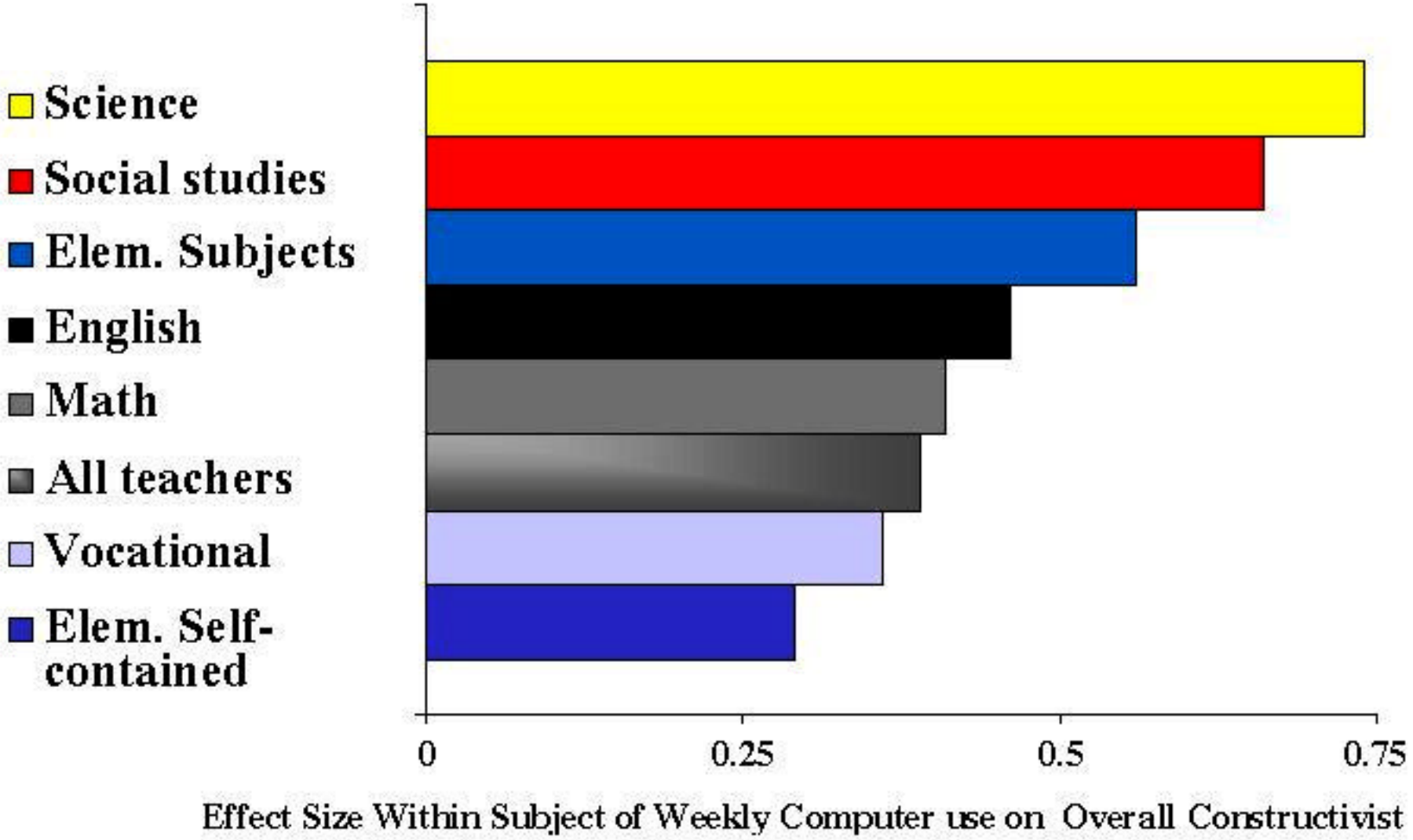
PROJECTS & DEEP THINKING

Effect sizes for Weekly Computer Use in Selected Subjects



Overall Practice: Effect Size of Weekly Student Use

In SOME subjects, weekly computer-assigning teachers are substantially more constructivist

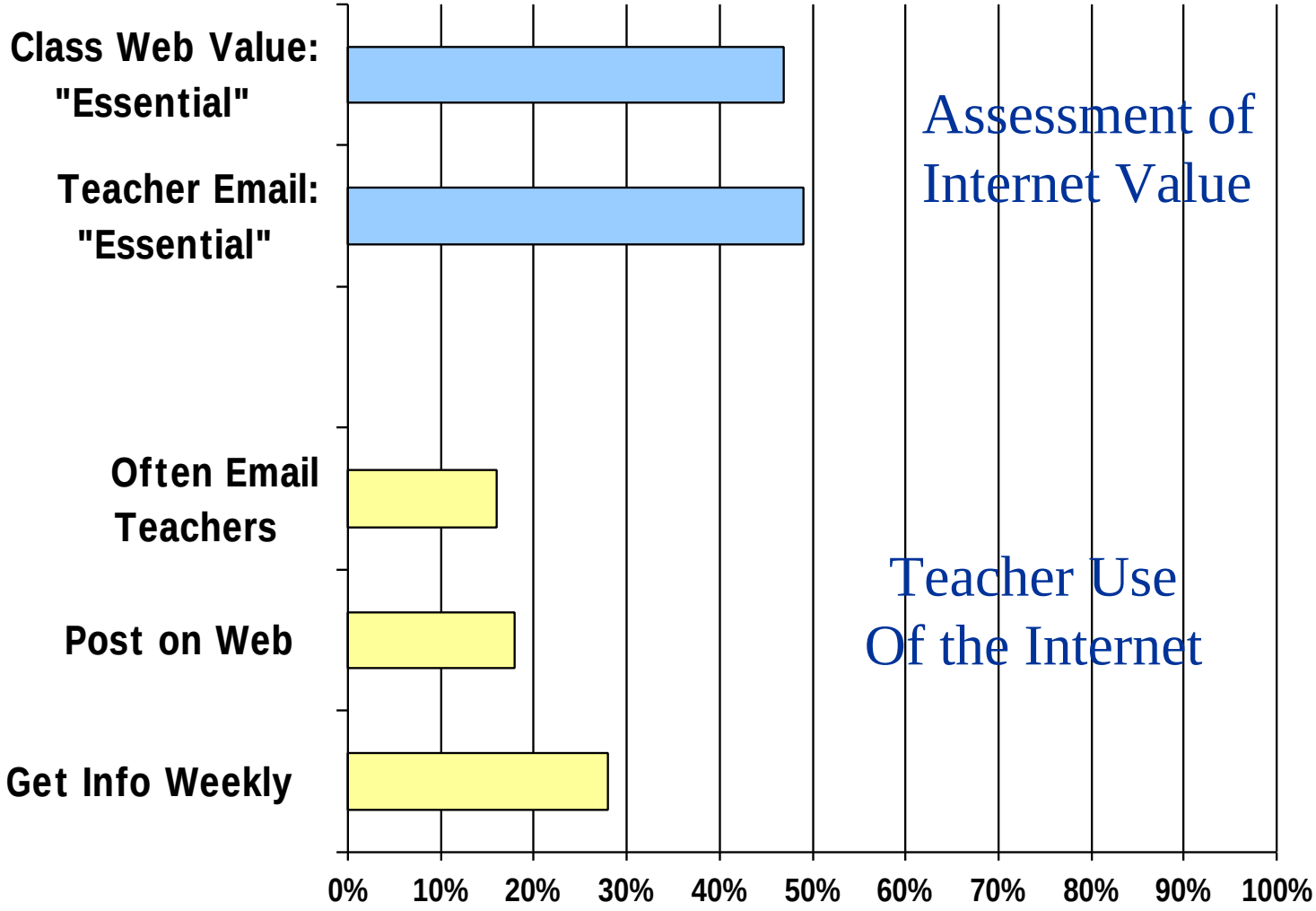


Practice scores, by Subject & Level

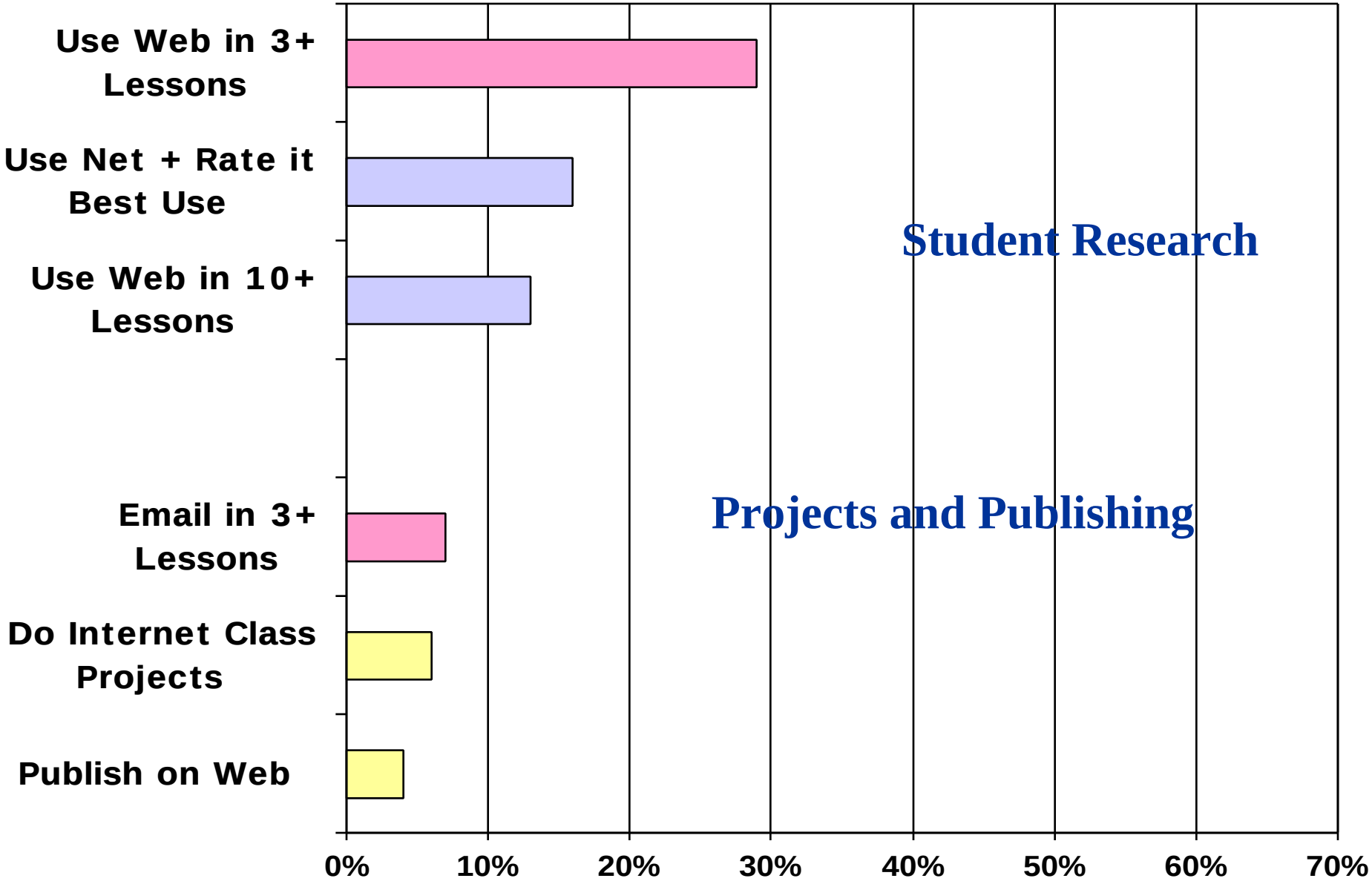
	Projects		**Group Work**		**Problem-Solving**		**Reflective Writing**		**Divergent Thinking**	
	1.59	Fine arts							0.61	English (H)
	1.37	**Vocational**			0.37	**Vocational (H)**	0.75	English (H)	0.34	English (M)
Z > +0.25	**1.11**	**Computer**	**0.26**	**Vocational (H)**	0.33	Math (M)	0.67	English (M)	0.25	Elementary
Above avg.	**1.09**	**Business (H)**	0.26	Science (M)	0.25	Elementary	0.42	Elementary	0.25	Soc studies (H)
	All Others									
Below avg.	-0.33	For. Lang. (H)	-0.24	Soc studies (M)	-0.27	English (M)	-0.28	Science (H)	-0.29	For. Lang. (H)
Z < -0.25	-0.74	Math (M)	-0.32	**Fine arts (M)**	-0.51	Soc studies (M)	**-0.45**	**Vocational (H)**	**-0.39**	**Vocational (M)**
	-1.00	Math (H)	**-0.64**	**Computer (H)**	-0.53	For. Lang (H)	-0.53	Math (M)	**-0.40**	**Computer (H)**
			-0.77	**Fine arts (H)**	-0.64	**Fine arts (M)**	-0.60	Fine arts (H)	-0.44	Fines arts (H)
			-0.78	**Business (H)**	-0.76	**Business (H)**	**-0.61**	**Business (H)**	**-0.51**	**Computer (M)**
							-0.75	Fine arts (M)	-0.56	Math (H)
							-0.83	Math (H)	**-0.65**	**Business (H)**
							-0.84	**Computer (H)**	-0.70	Fine arts (M)

What about the Internet?

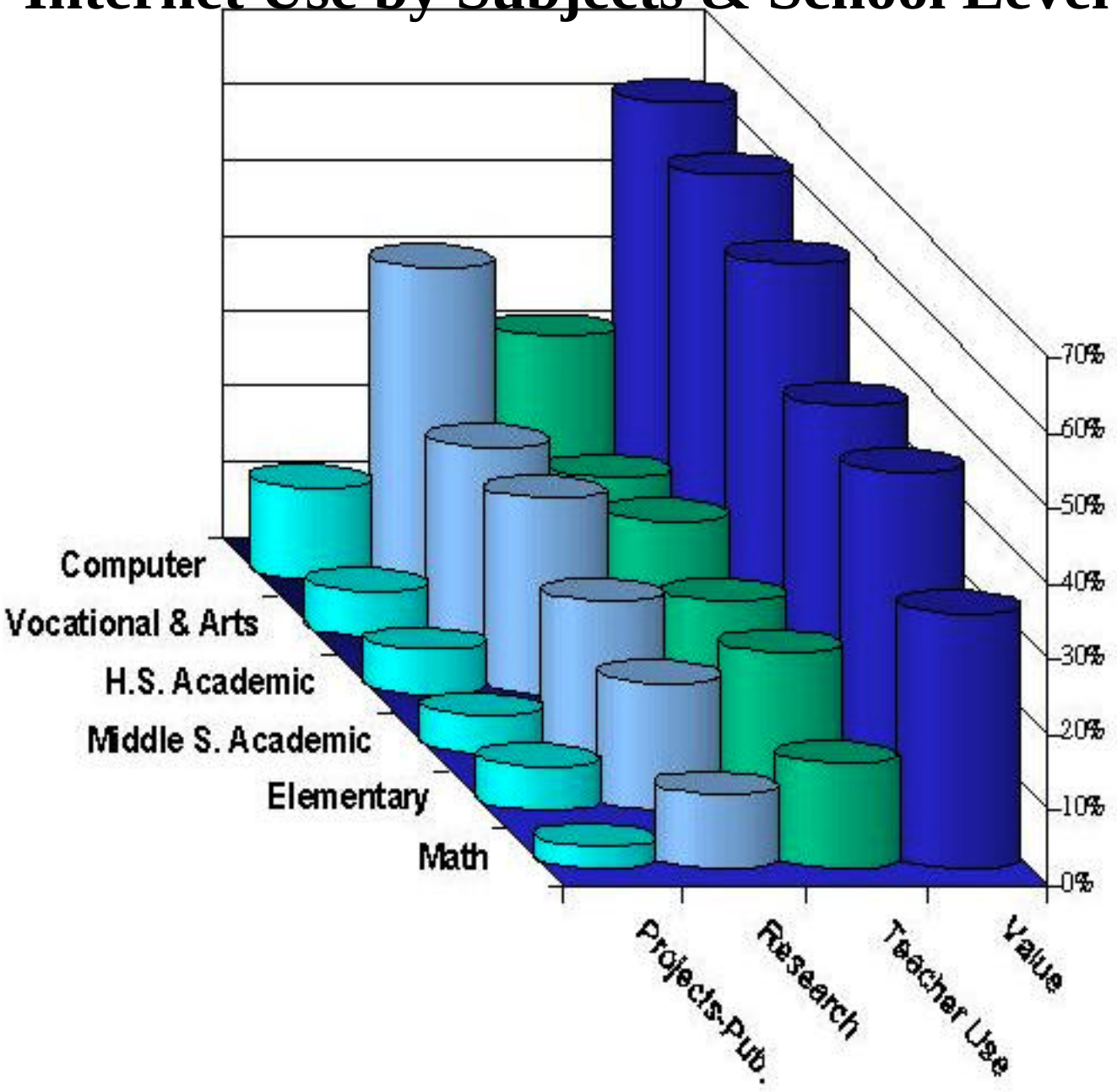
Teacher Value and Use of the Internet



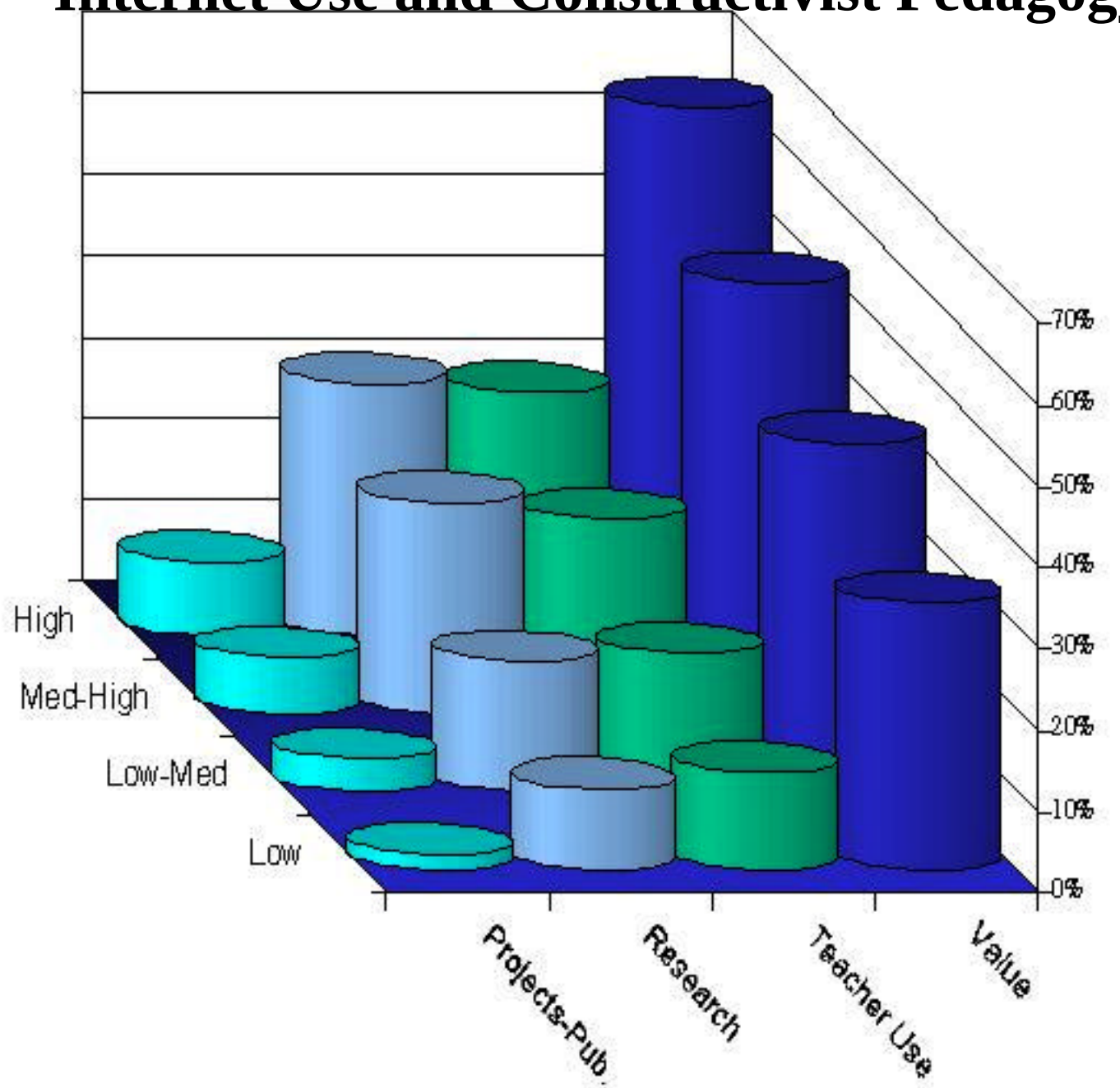
Teachers Report that their Students Used the Internet in these Ways:



Internet Use by Subjects & School Level



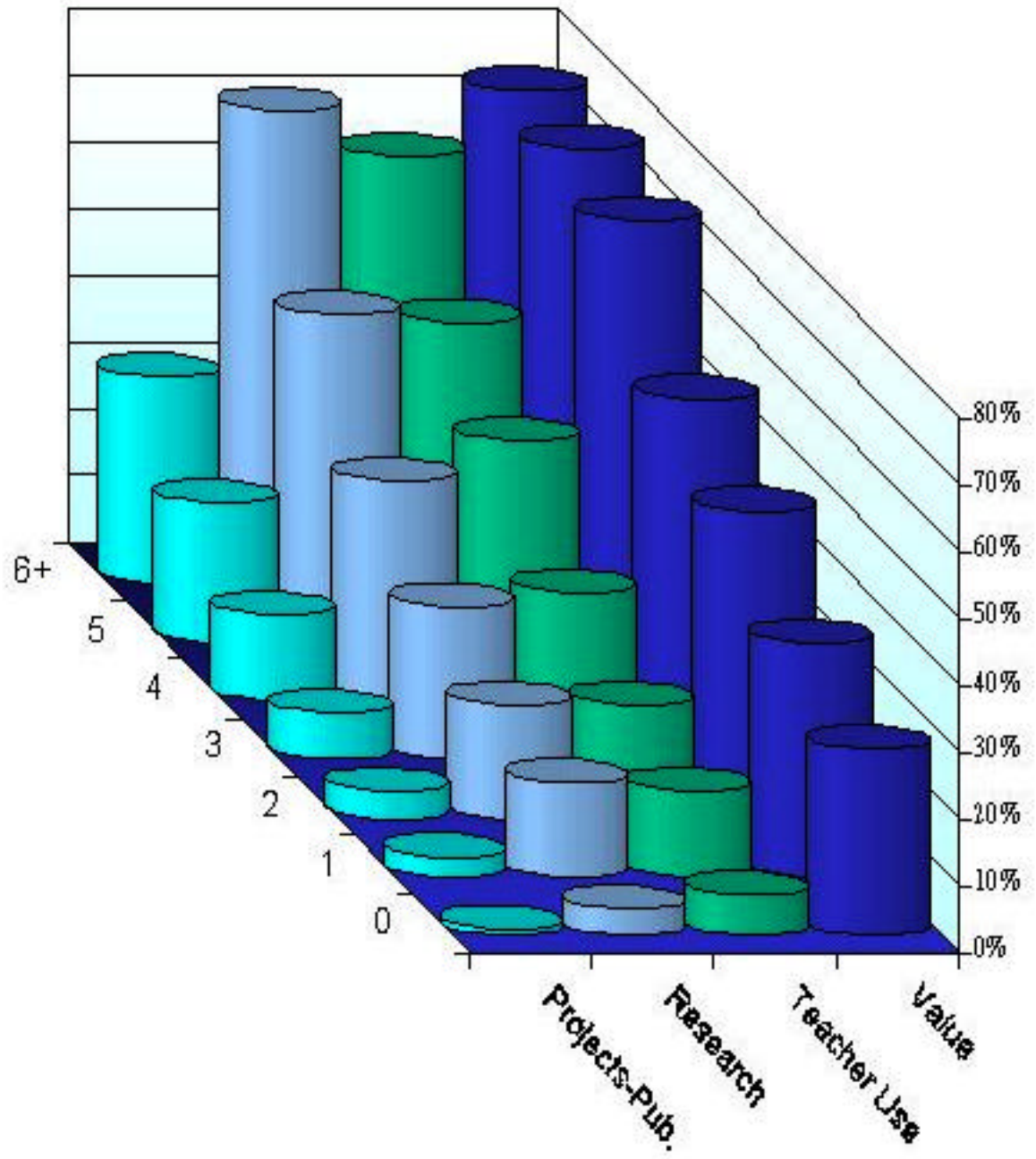
Internet Use and Constructivist Pedagogy



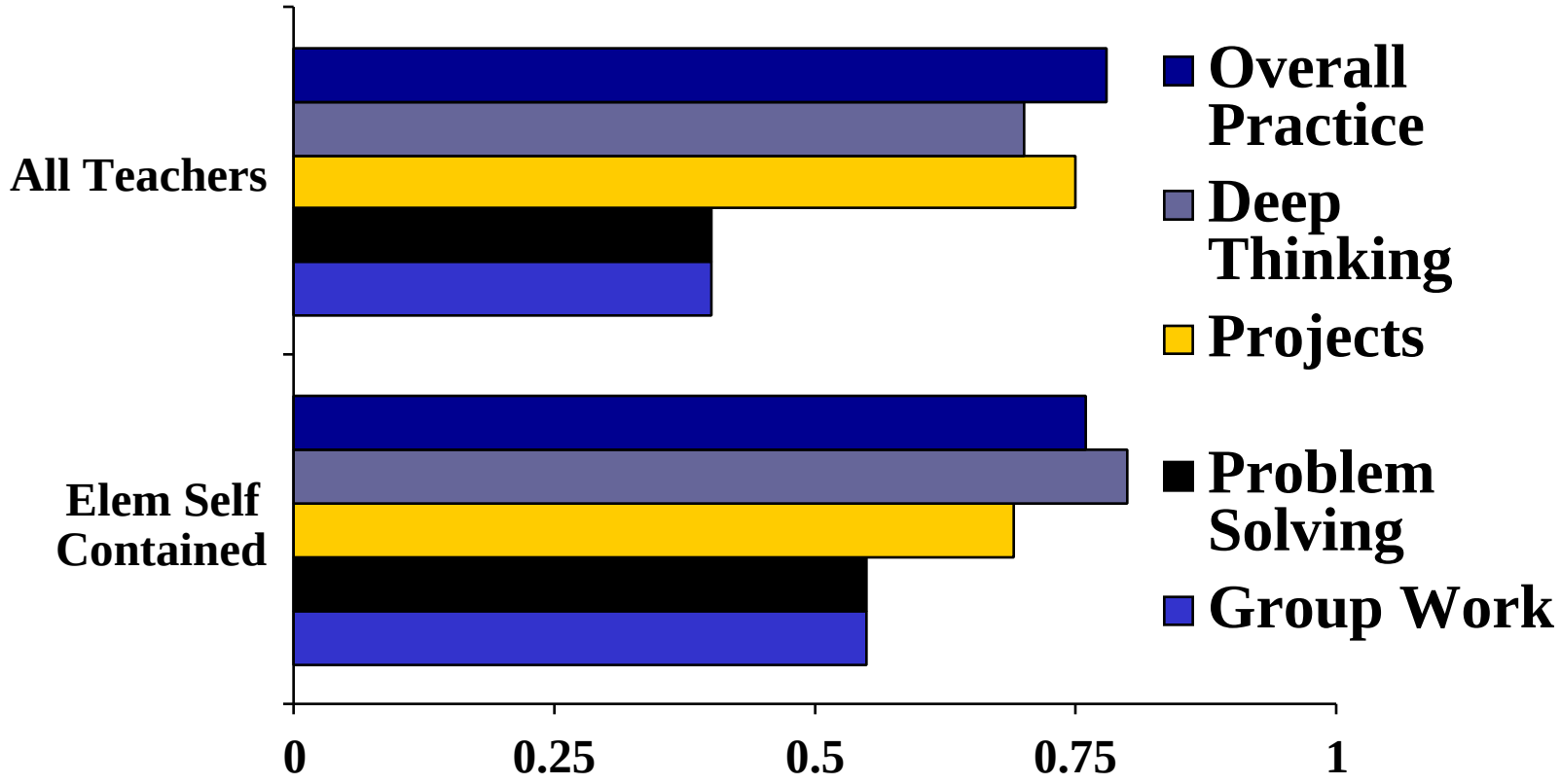
The Strongest Predictors of Internet Use

- **High-Speed Internet Access in the Teacher's Own Classroom**
- **Constructivist Pedagogical Beliefs and Practices (high score on scale)**
- **Self-reported Computer Skills (high score on scale)**
- **Have Computer and Modem at Home**
- **Informal Contacts with Other Teachers at School (high score)**
- **Professional Leadership Activities (high score)**
- **Formal Staff Development on Internet Use**
- **Have Used Computers with Students for at least 3 Years**

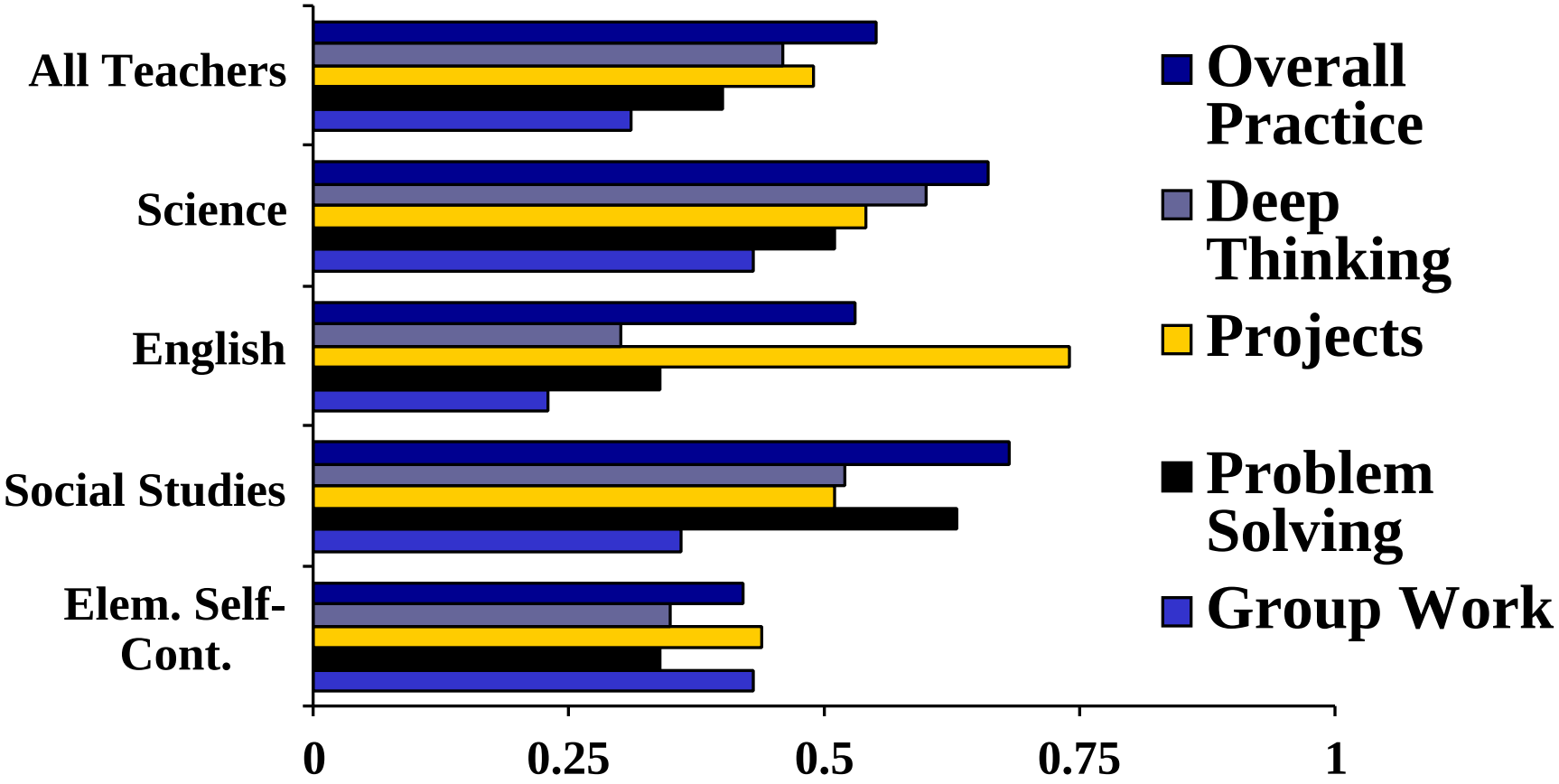
Internet Use by Number of Conditions Present



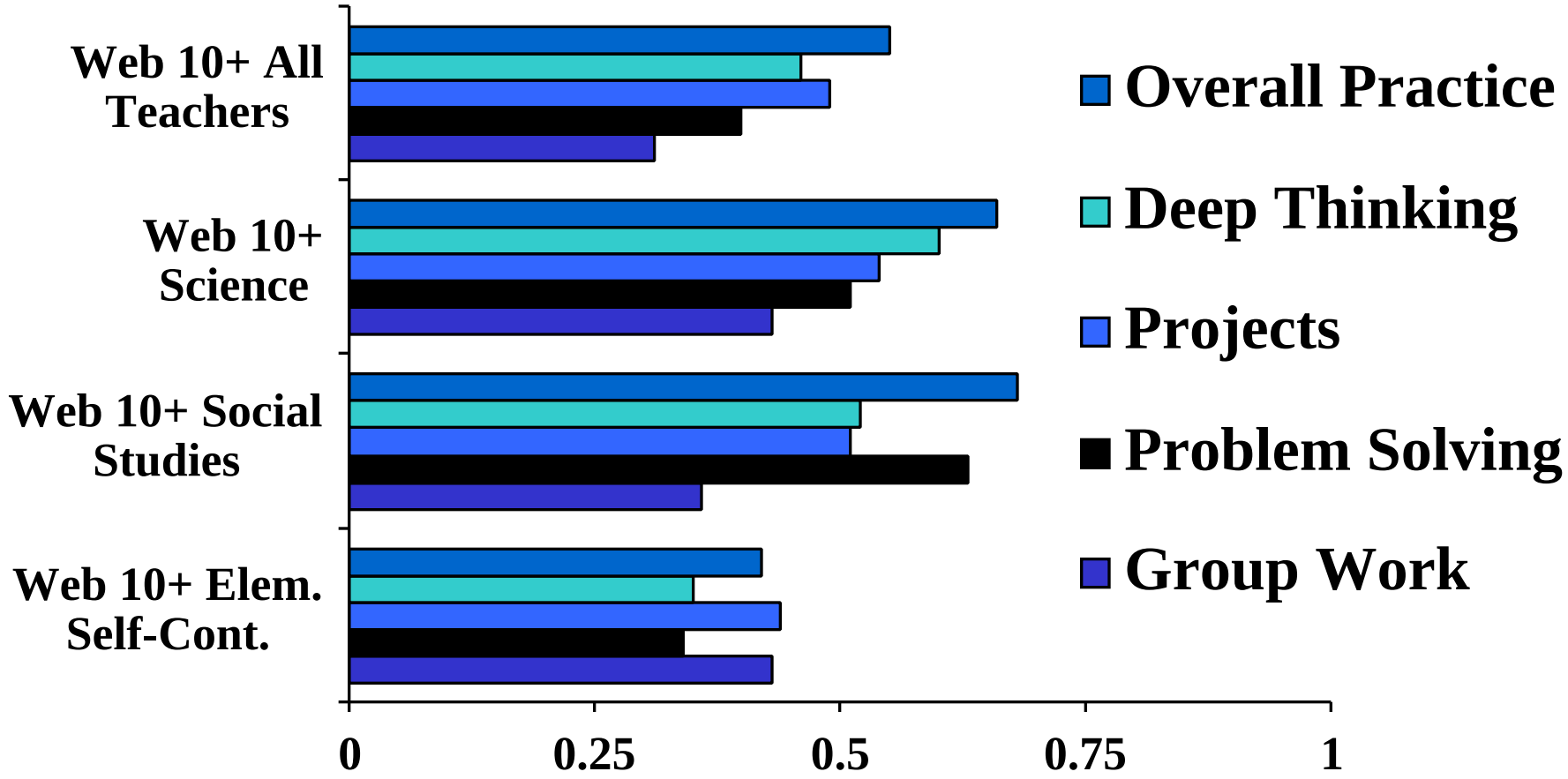
OVERALL PRACTICES:
Effect size of Student Email Use (10+ times)



OVERALL PRACTICES:
Effect size of Student WEB Use (10+ times)



OVERALL PRACTICES: Effect size of Student Web Use (10+ times), by Subject



Next Steps

- Specific Software Uses by Subject
- Differences in All Schools vs Reform Programs
- Introducing Control Variables