

**When Does Project-Based
Teaching Lead to Cognitive Challenge?
Data from the TLC 1998 National Survey**

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Teaching, Learning, & Computing--1998

- A representative sample of all U.S. teachers in grades 4-12 (Probability Sample)
- A sample of teachers from schools in major reform projects and schools with high-end technology (Purposive Sample)
- Over 4,100 teachers in 1,100 schools participated, nearly 70% of those sampled
- Completed 20 page questionnaires
- Also, data from principals and school technology coordinators in the same schools

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

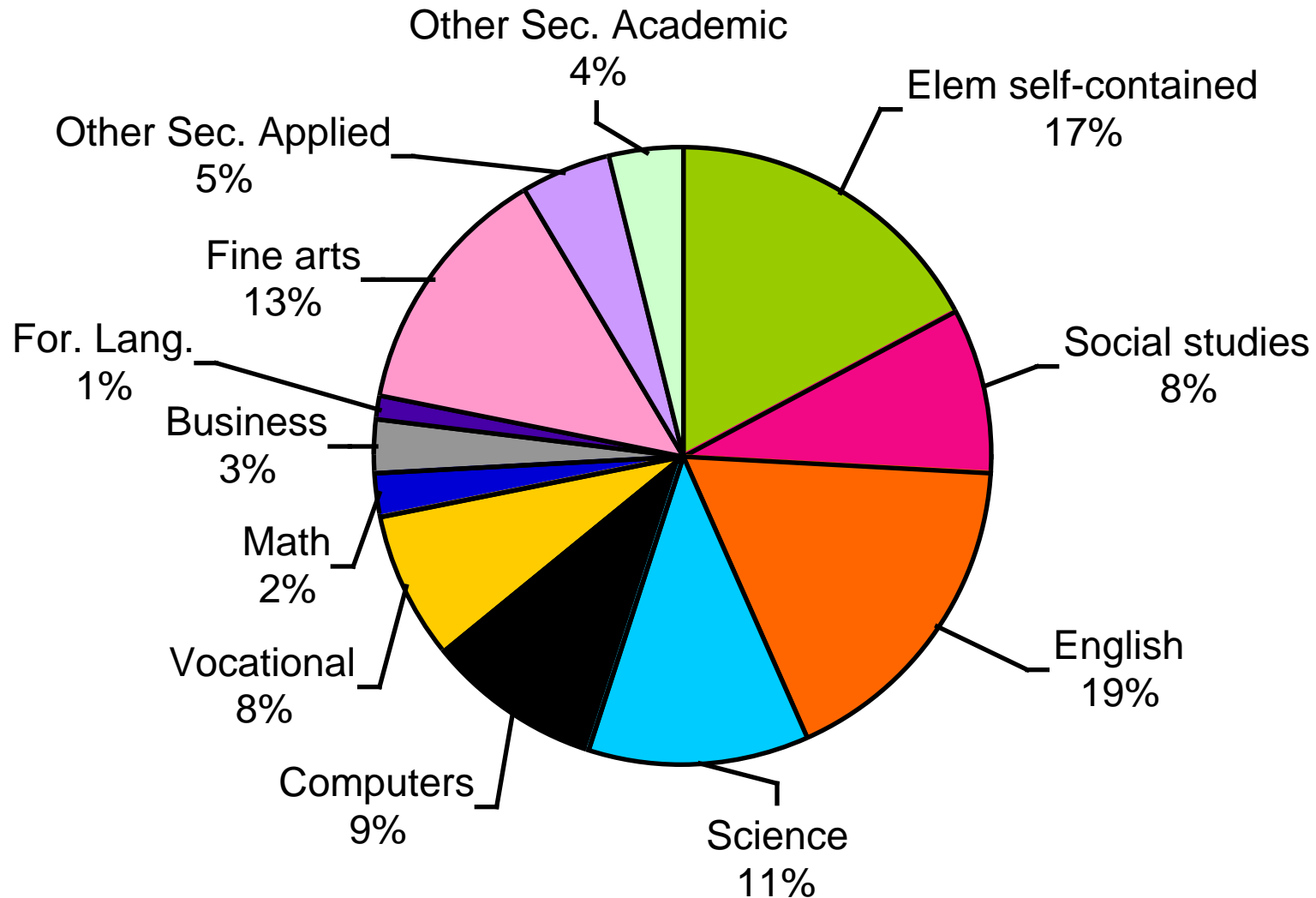
Background

- What Types of Project-based Activities?
- What Types of Cognitive Challenges?
- Why are we concerned about relationship
 - Different subjects score higher on each
 - But, there is a relationship overall

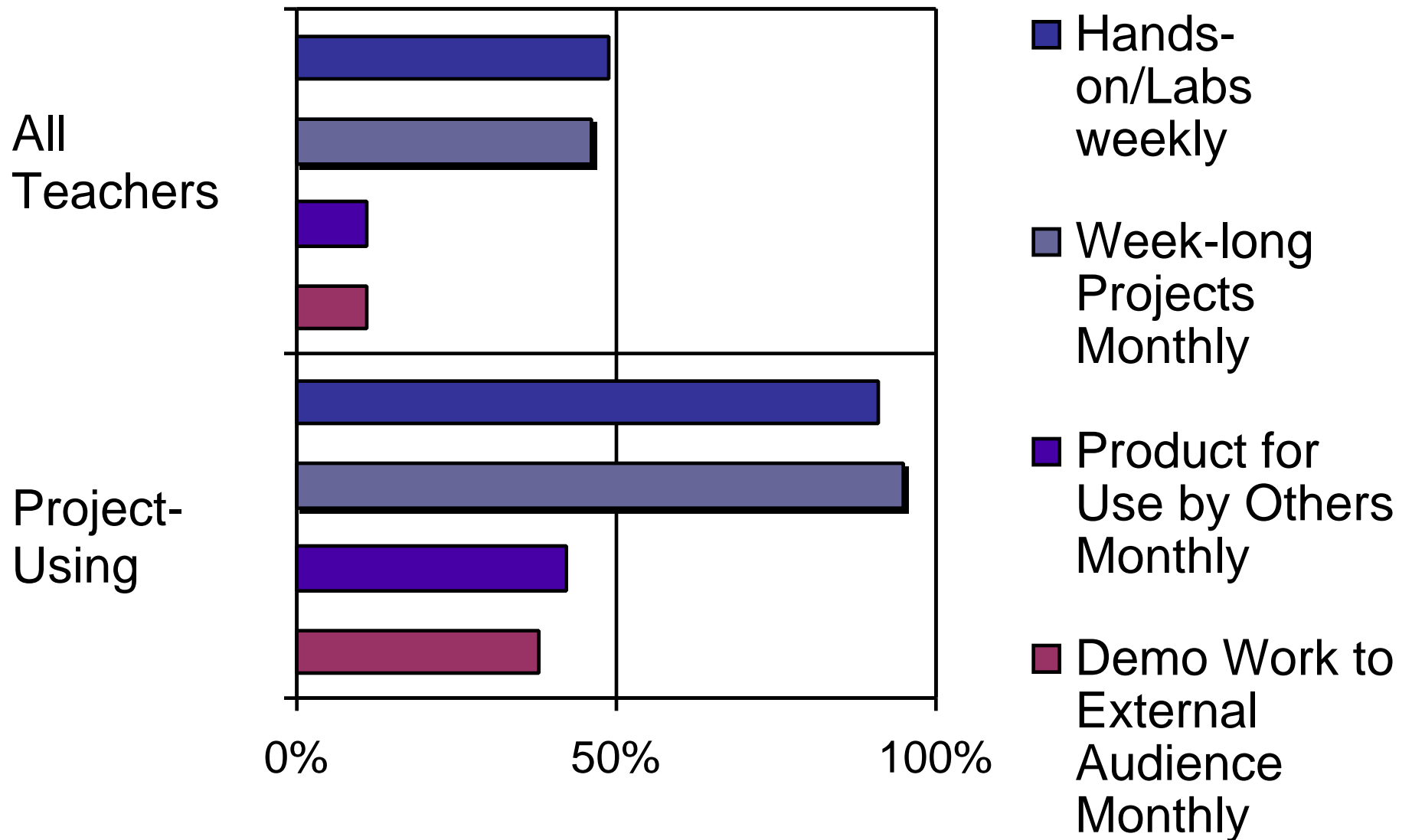
What types of Project Activities did we ask about?

- Hands-on/Lab Activities, Weekly
- Week long projects, Monthly
- Creating products for use by others
- Presenting work to audience beyond school and parents

Top 20% of Projects Overall: Breakdown by Subject

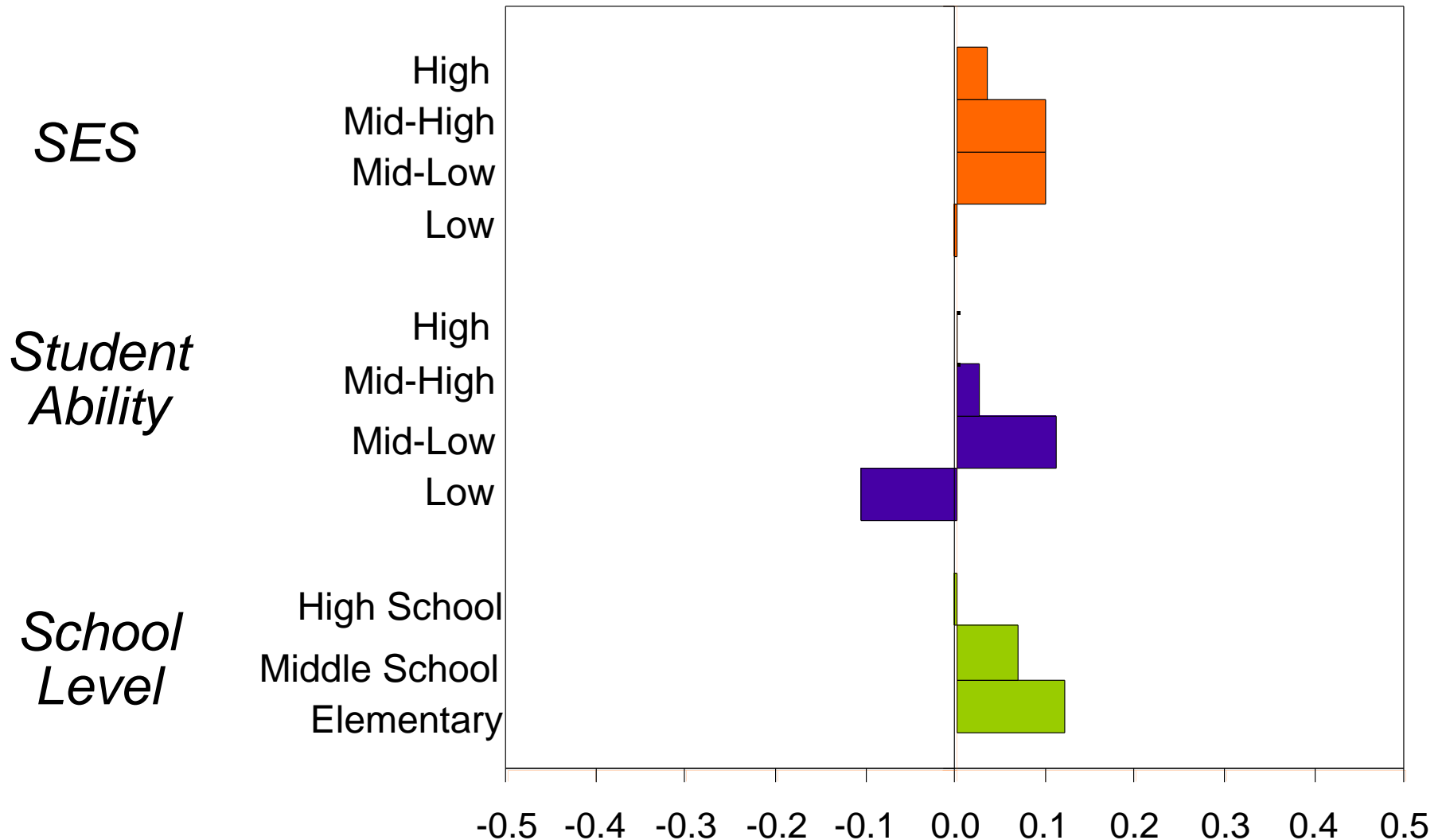


Frequency of Project Activities



Who are the Project Using Teachers?

Minor differences in scores on Projects, by Background Variables (all teachers)



What types of Cognitive Challenges?

- **Problem-solving Activities, where students...**
 - 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
- **Reflective Writing...where students write...**
 - Journals
 - Essays explaining their thoughts at length...
 - Self-assessments

More Indicators or Cognitive Challenge

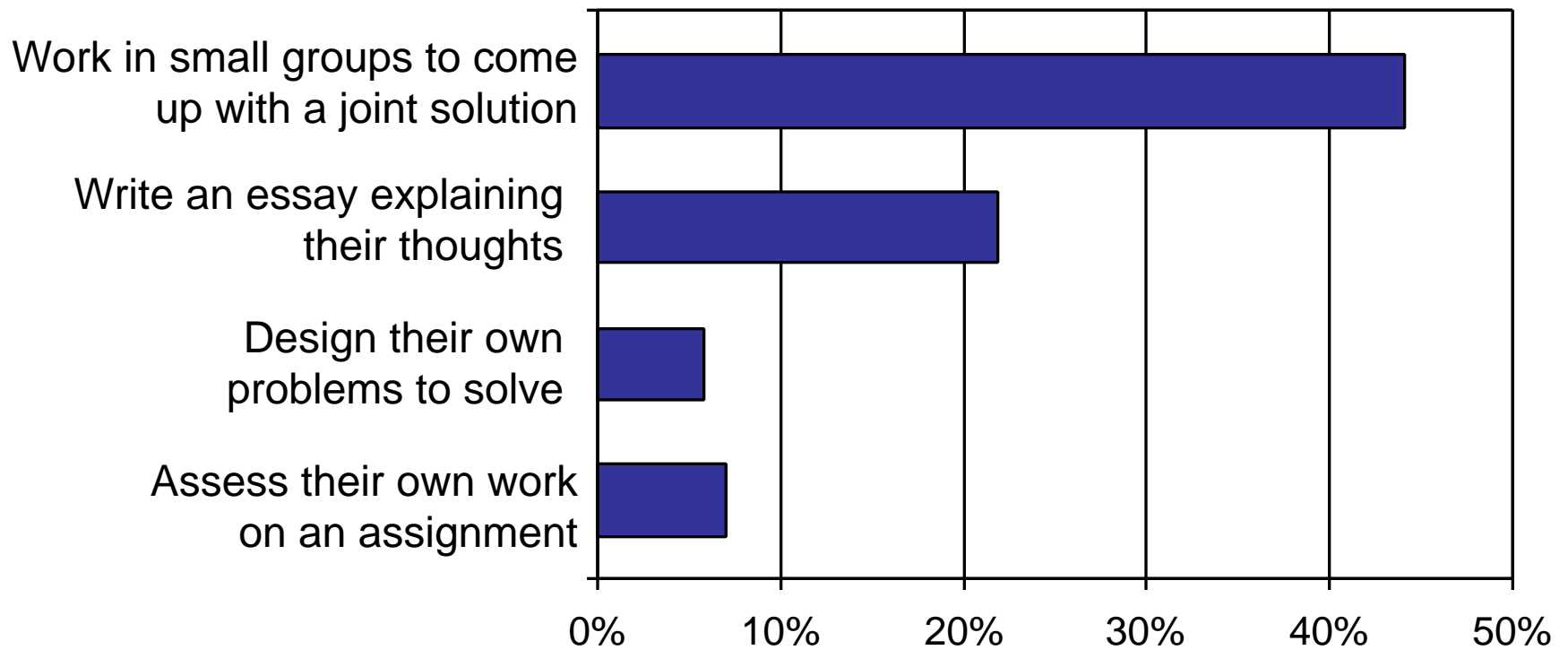
Other “Meaningful Thinking” Tasks... Where Students...

- Work on tasks with no indisputably correct answer...
- Suggest or help plan classroom activities or topics...
- Debate and argue point of view, perhaps not be their own...
- Represent the same idea/relationship in more than one way...
- Make conjectures about what they would learn...
- Lead a discussion or presentation for > 1 hour in last 5

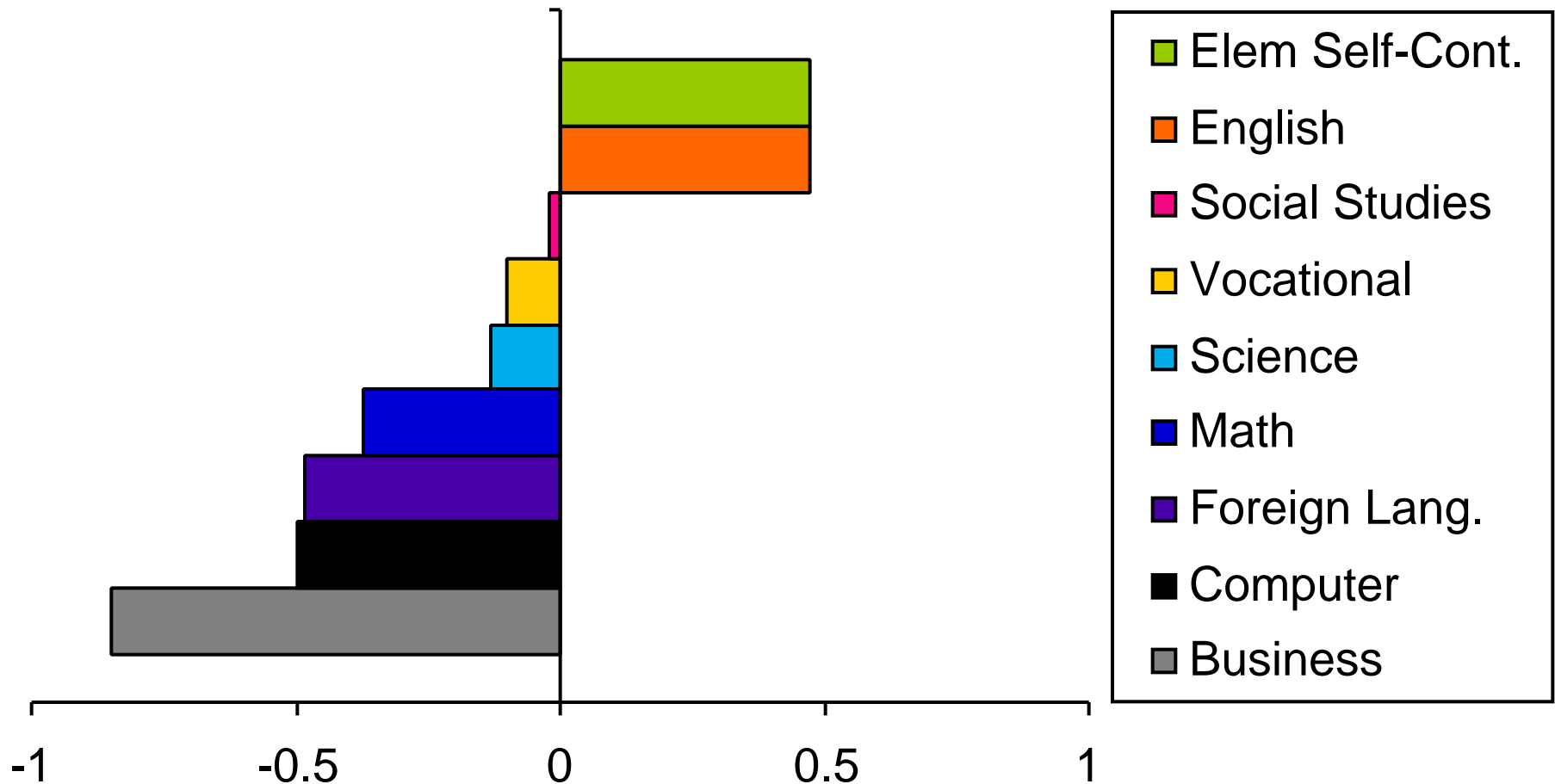
Or where the Teacher....

- raises unanswered questions
- elicits student ideas & opinions
- asks students to justify/explain reasoning
- asks students to relate work to their own experiences

Frequency of Some Cognitive Challenge Activities % weekly or more often



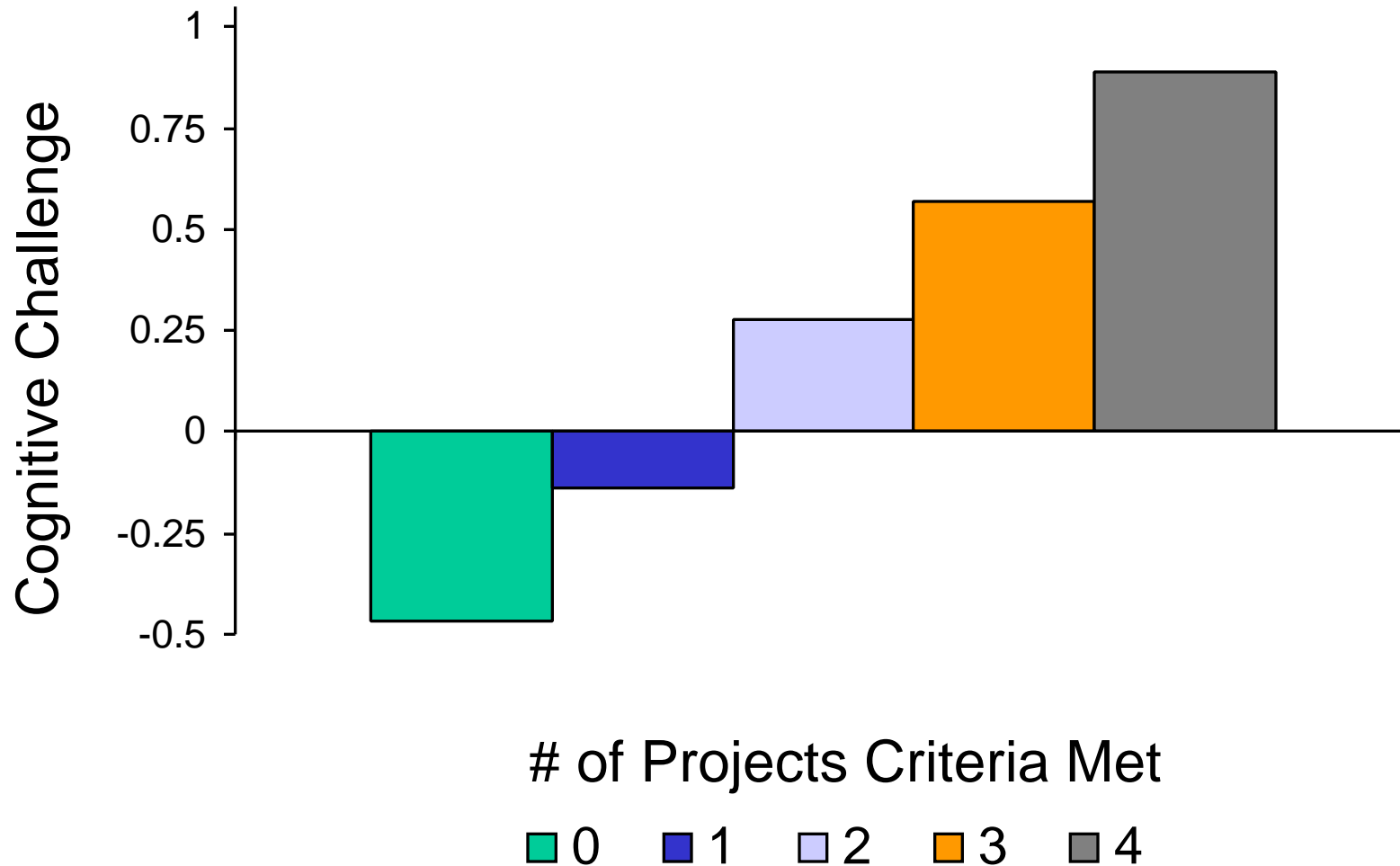
Extent of Cognitive Challenge Among All Teachers by Subject



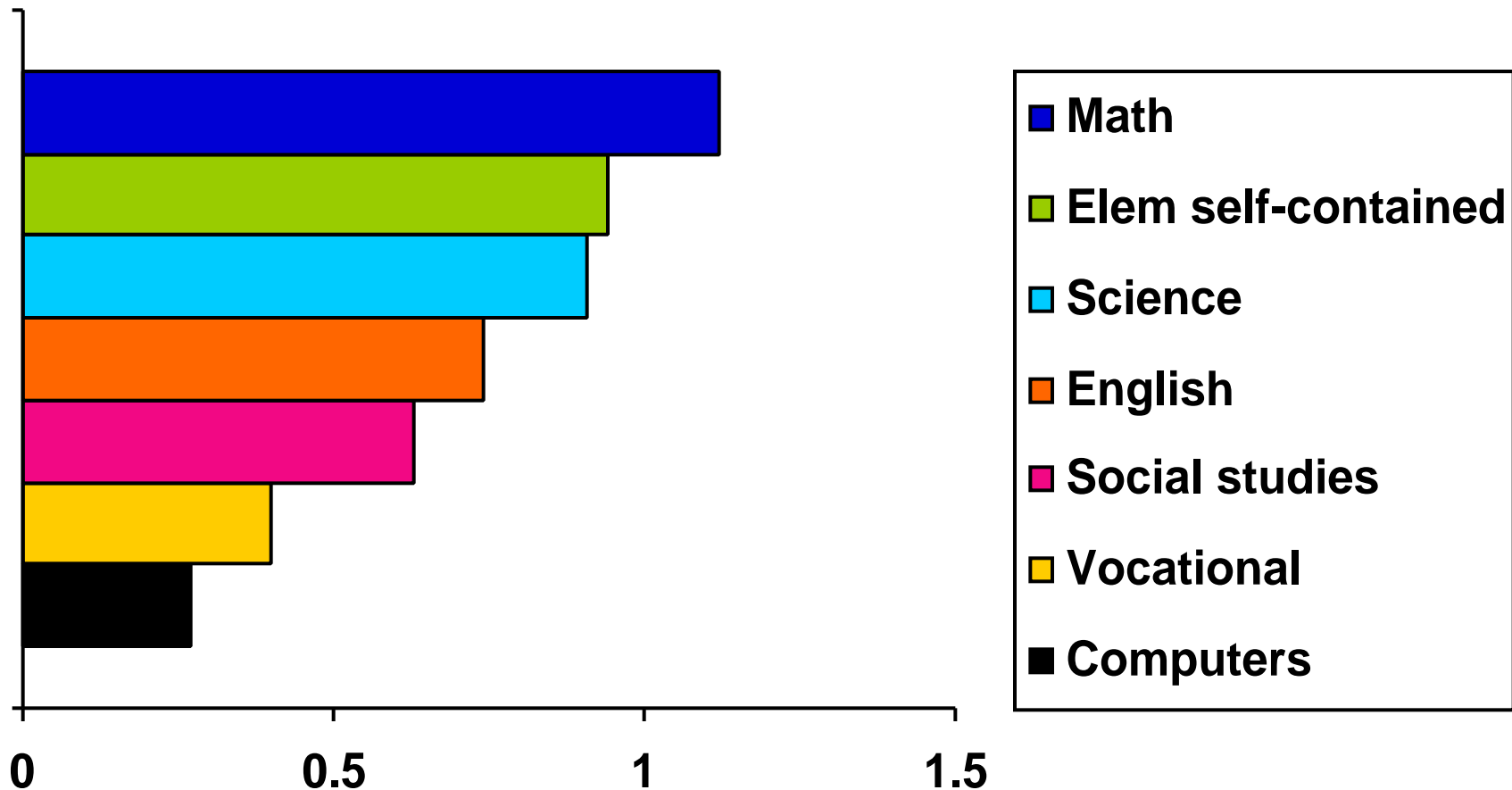
Generally, the Subjects Highest on Projects are the Subjects Lowest on Cognitive Challenge, but...

		Cognitive Challenges							
		Projects		Problem-Solving		Reflective Writing		Meaningful Thinking	
Z > +0.25 Above avg.	1.59	Fine arts					0.61	English (H)	
	1.37	Vocational	0.37	Vocational (H)	0.75	English (H)	0.34	English (M)	
	1.11	Computer	0.33	Math (M)	0.67	English (M)	0.25	Elementary	
	1.09	Business (H)	0.25	Elementary	0.42	Elementary	0.25	Soc studies (H)	
Below avg. Z < -0.25	-0.33	For. Lang. (H)	-0.27	English (M)	-0.28	Science (H)	-0.29	For. Lang. (H)	
	-0.74	Math (M)	-0.51	Soc studies (M)	-0.45	Vocational (H)	-0.39	Vocational (M)	
	-1.00	Math (H)	-0.53	For. Lang (H)	-0.53	Math (M)	-0.40	Computer (H)	
			-0.64	Fine arts (M)	-0.60	Fine arts (H)	-0.44	Fines arts (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)		

Overall, the More Project Activities, the Higher the Cognitive Challenge*



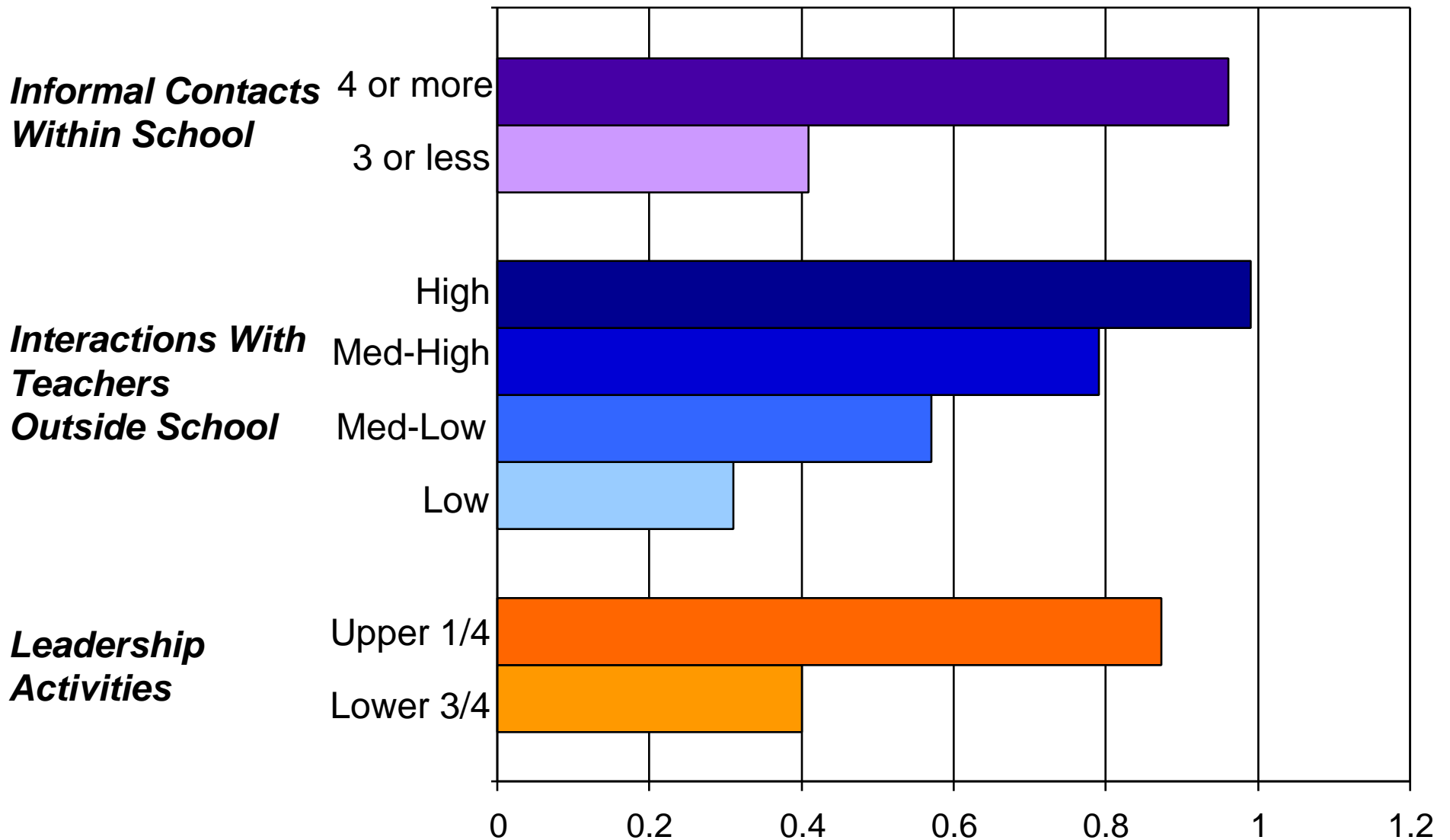
How much MORE Cognitive Challenge by Project-using Teachers vs. Others in Same Subject?



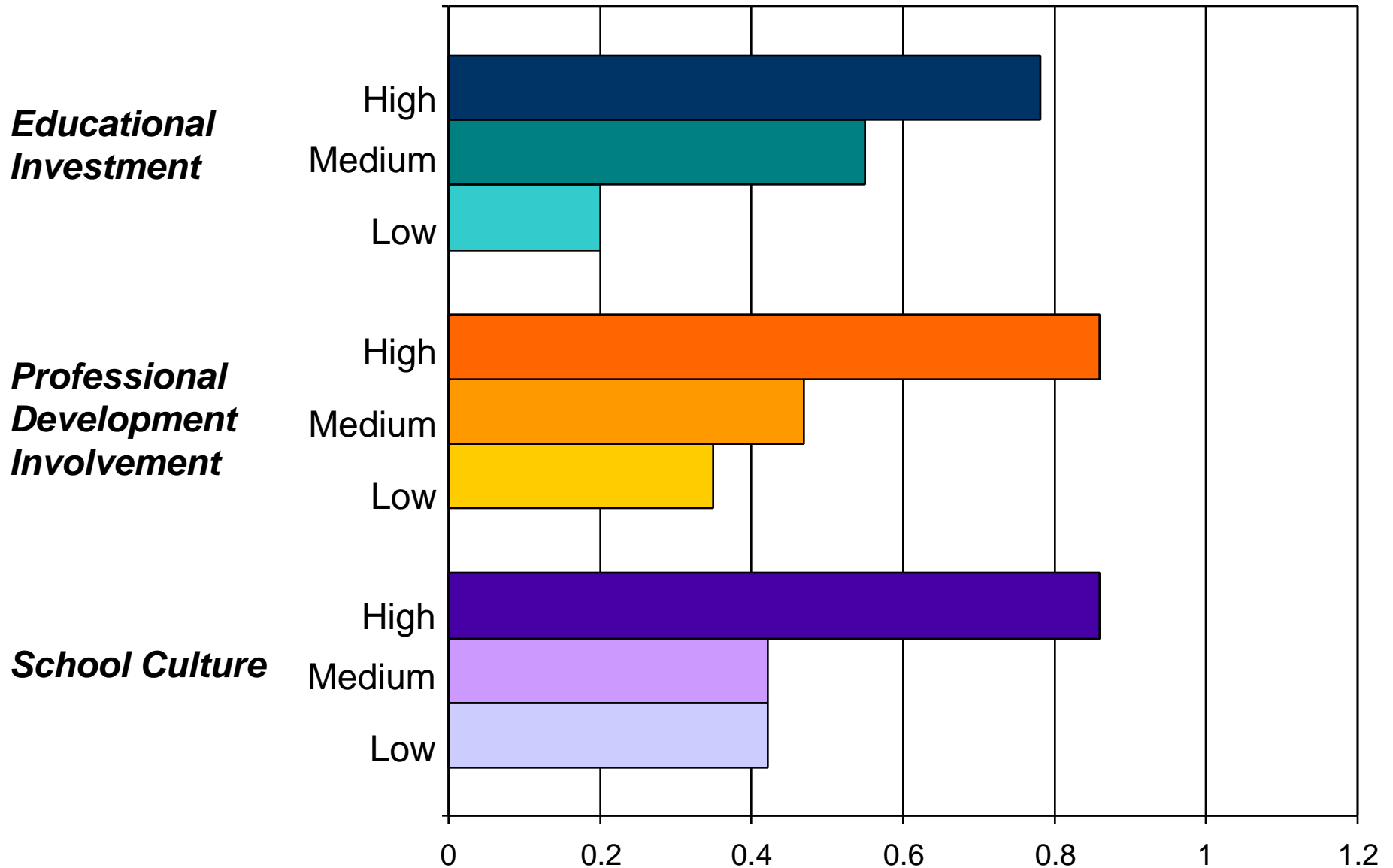
Which Project Users report the Most Cognitive Challenge?

- Selecting Project Users Only
- Comparing Teachers who Differ on...
 - Informal Contacts at School and Outside of School
 - Leadership
 - Personal Educational Investment
 - Participation in Professional Development
 - School Culture
 - Frequency and Variety of Computer Use with Students
 - Professional Use of Computers
 - Access to Technology Resources & Computer Expertise

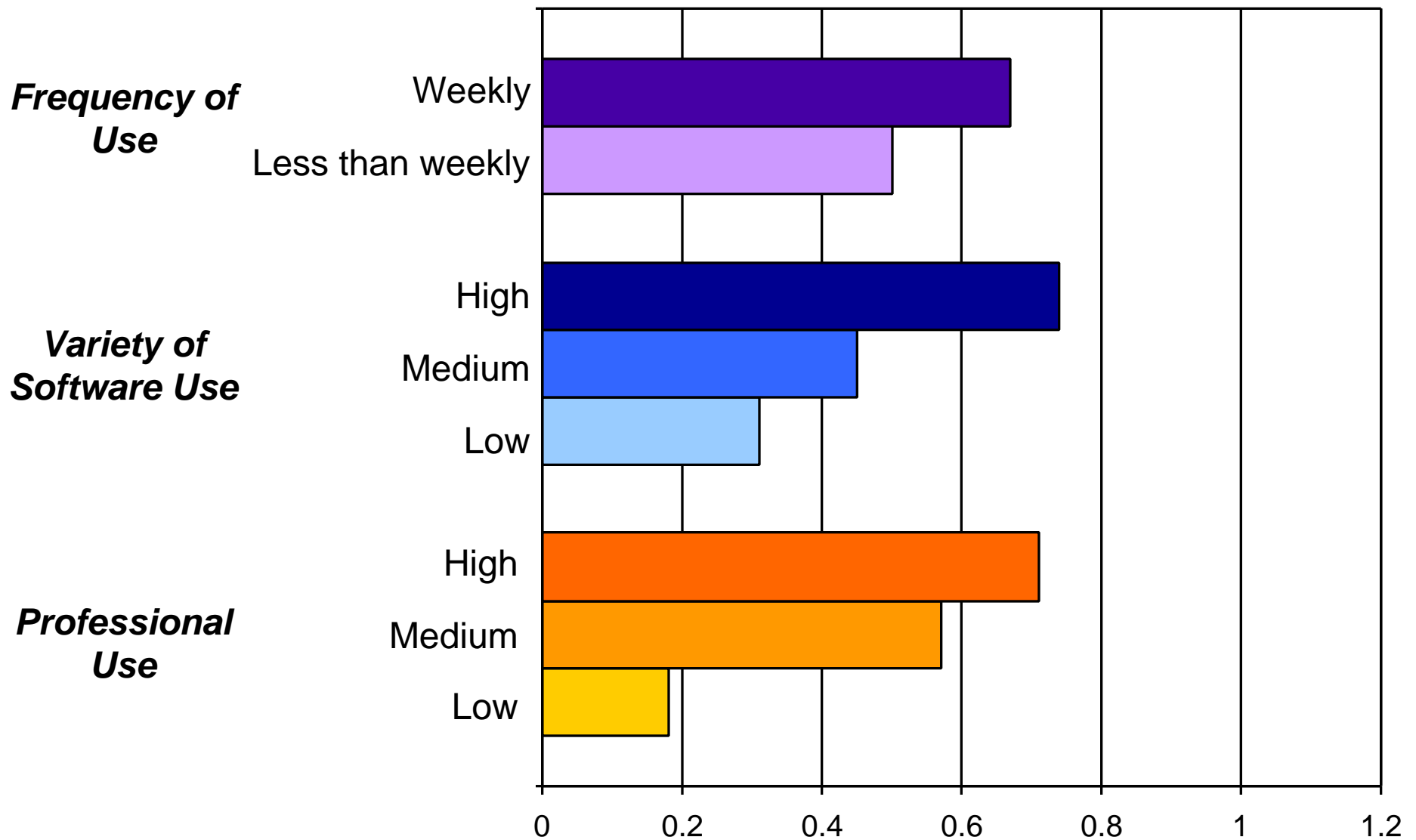
Relationship of Teacher Professional Orientation to Cognitive Challenge Among Project-Using Teachers



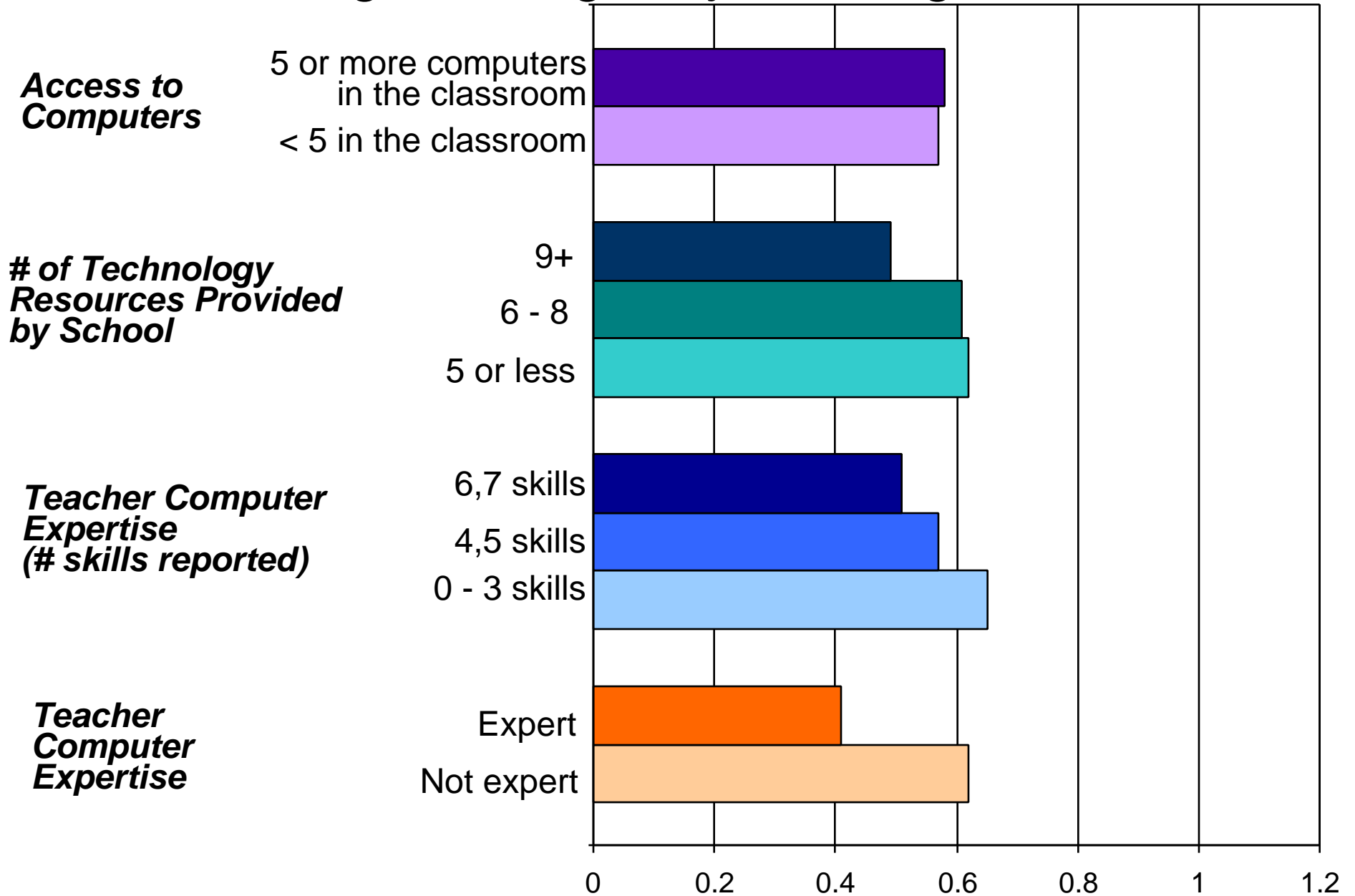
Relationship of Teacher's Involvement in Professional Development, School Culture, and Educational Investment of Teacher on Cognitive Challenge, among Project-Using Teachers



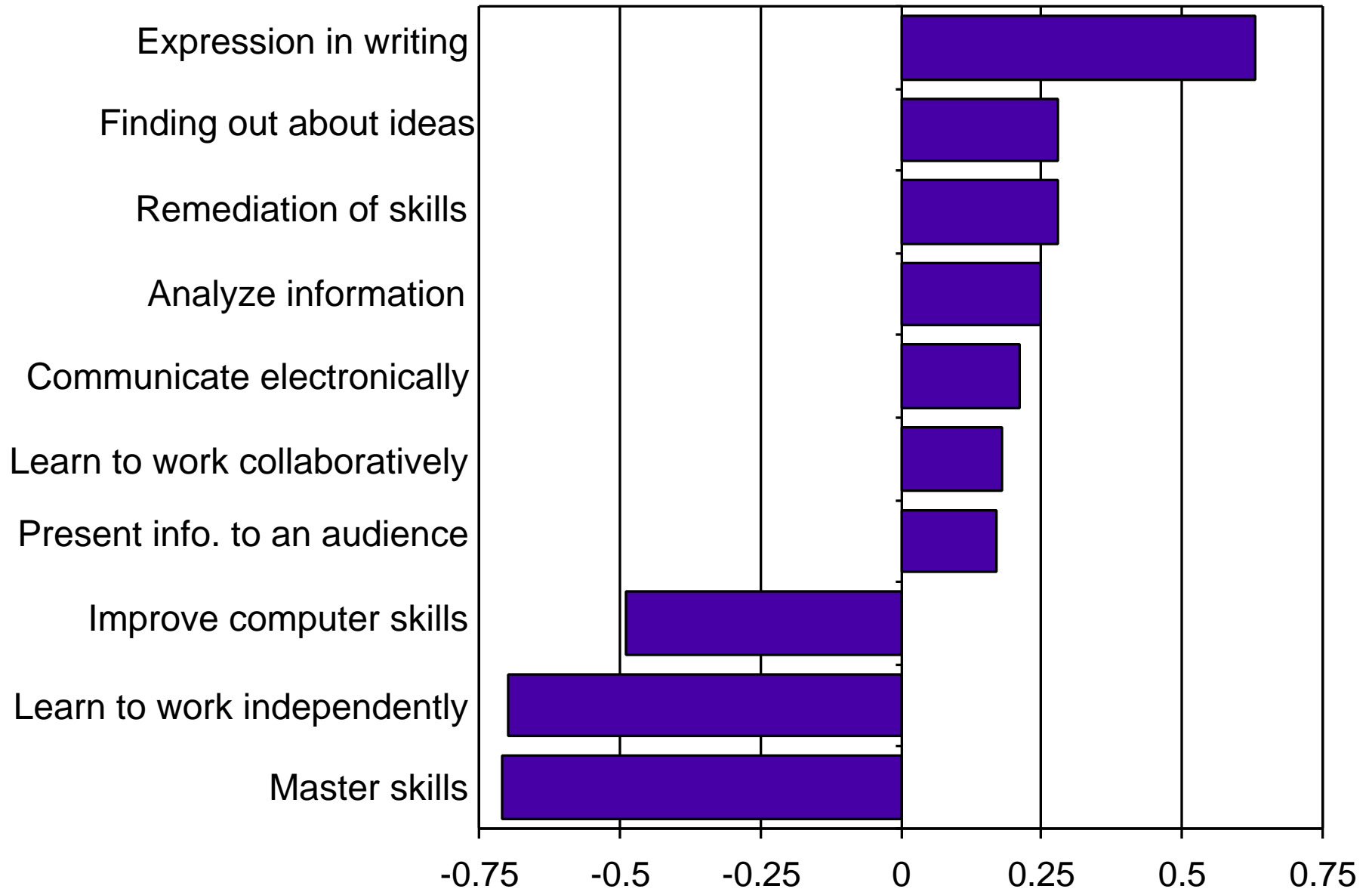
Computer-related items positively related to Cognitive Challenge among Project-using Teachers



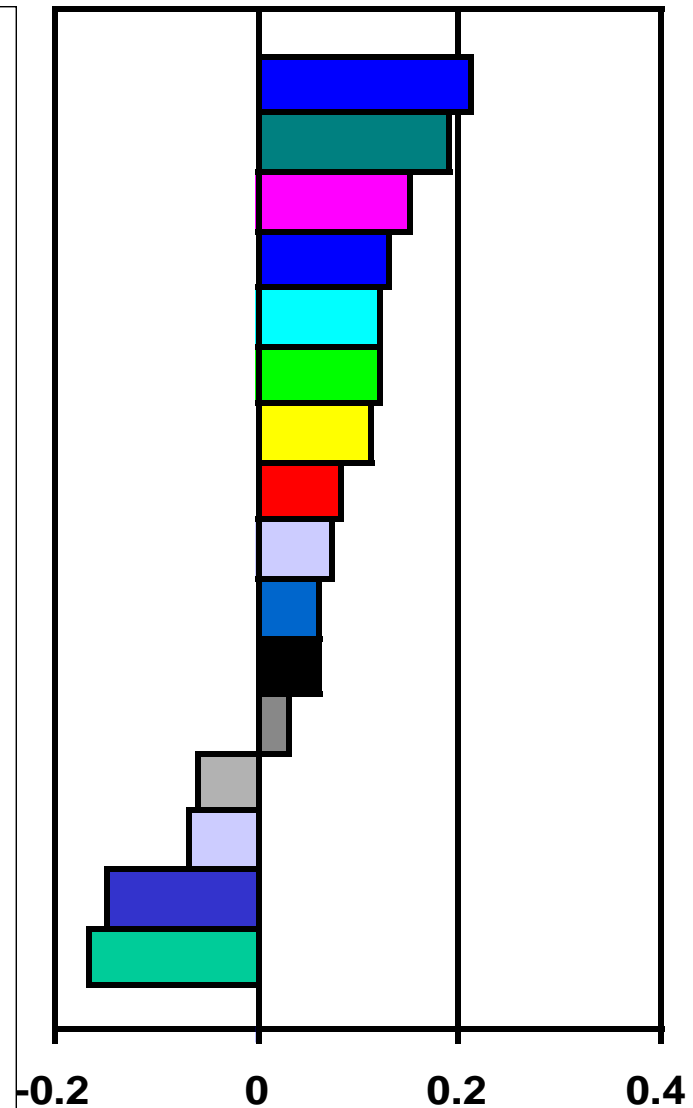
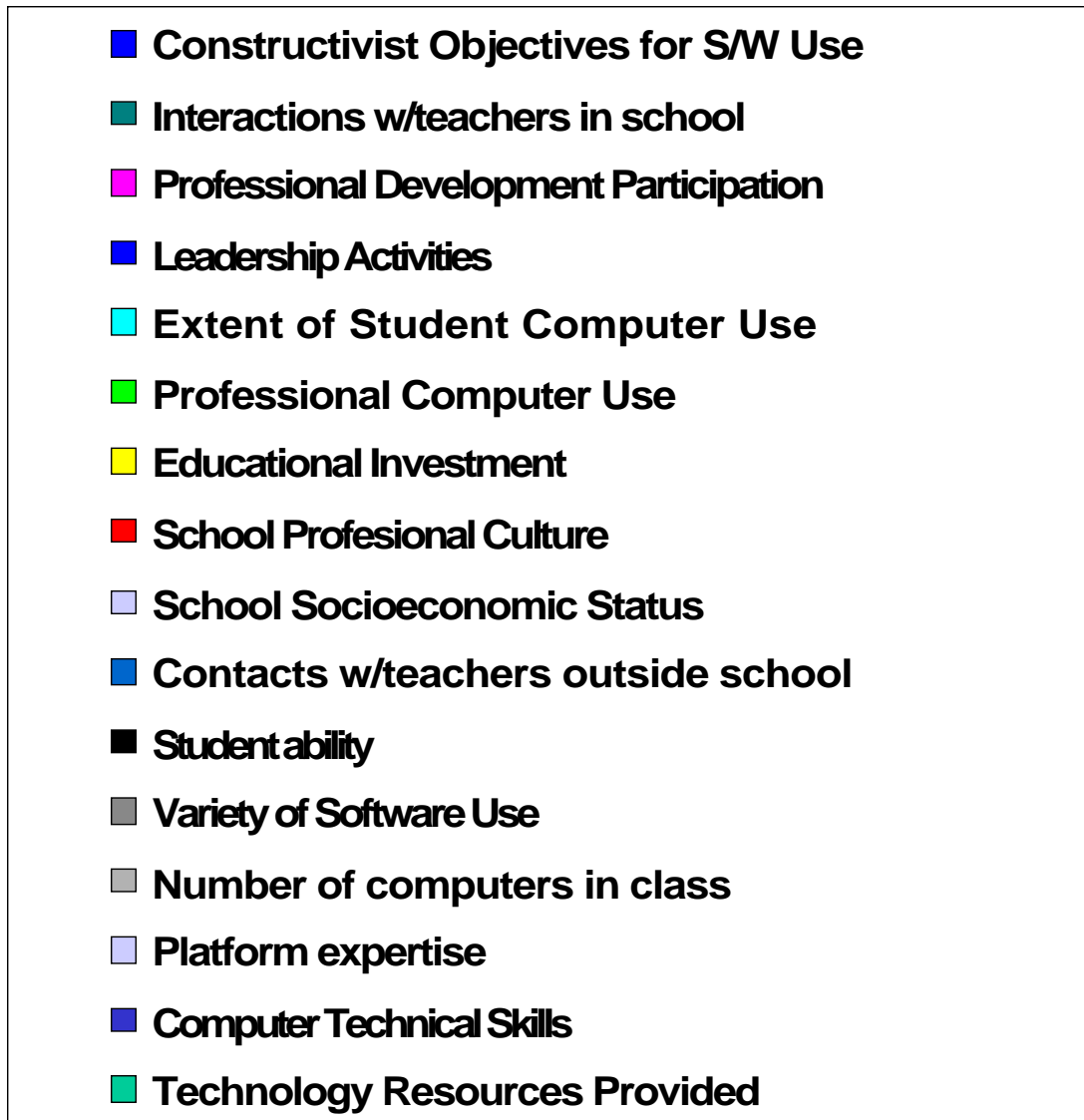
Computer-related items NOT related to Cognitive Challenge among Project-using Teachers



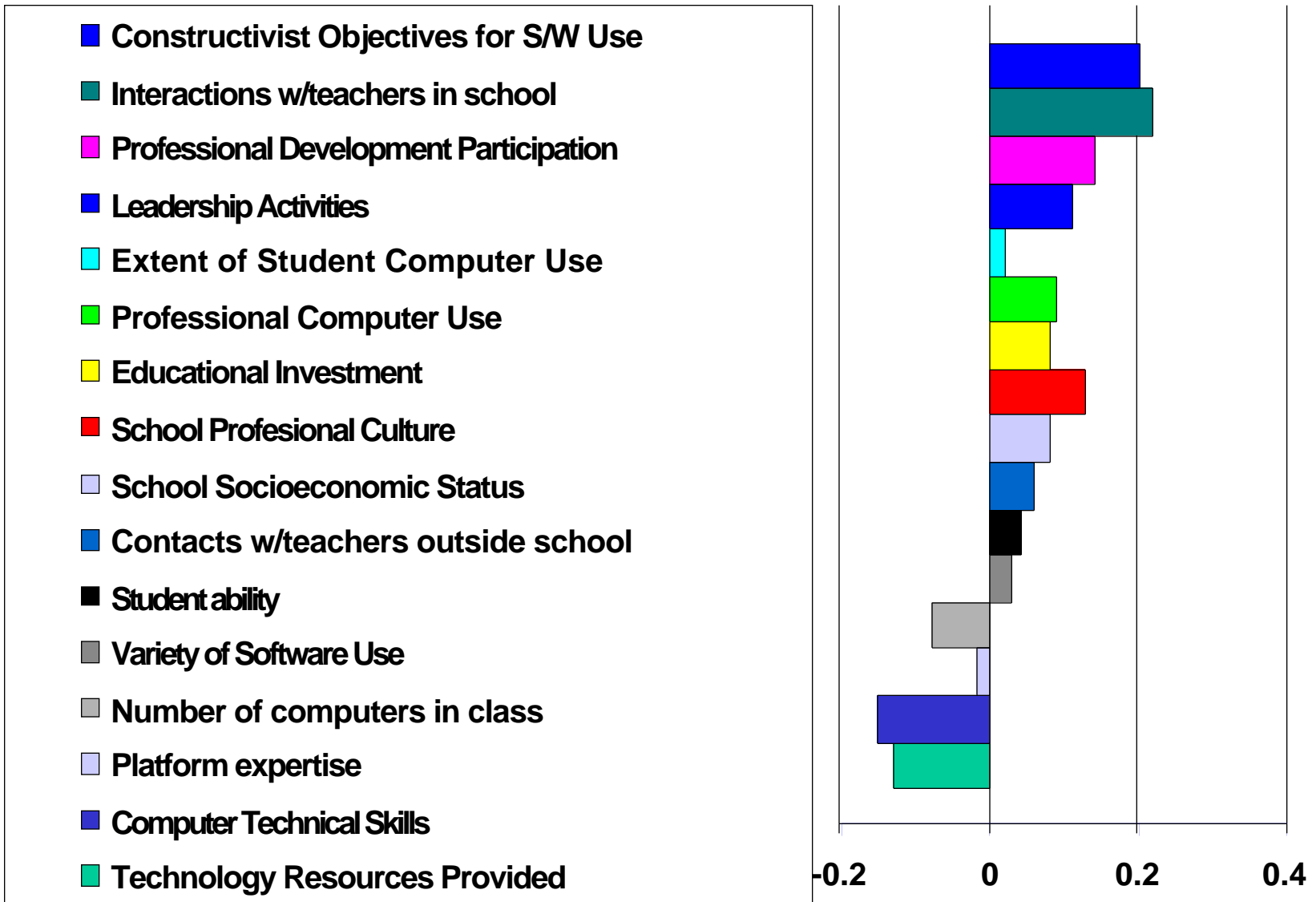
Software Use Objectives (in Top 3) related to Cognitive Challenge among Project-using Teachers



All Project Using Teachers: Unique effect of Variables on Cognitive Challenge



Computer-Using Project-Using Teachers: Unique Effects of Variables on Cognitive Challenge



Non-Technology Programs

Nature of Entity	Program Participation at What Level	Programs or other Sources/ Number of programs participating	Schools Participating/ Completed Surveys
Reform Programs	School-wide external programs	Accelerated Schools, ATLAS, Center for Collaborative Education (Teachers College), Coalition of Essential Schools, National Alliance for School Restructuring. Total = 21 programs	140 / 425
	School-wide individual school programs	Charter Schools, U.S. Dept. of Ed. Promising Practices. Total = 5 programs	32 / 104
	Department-wide	UCAN RSI, Milwaukee USI, City Science, CSMP / Total = 4 programs	26 / 76
	Individual teacher participants	Impact II, Project 2061 (AAAS), UCSMP / Total = 8 programs	59 / 220*
Teacher Recognition	Individual teacher participants	Milken Foundation, National Board for Professional Teaching Standards / Total = 2 programs	31 / 109*
Subtotal: Non-Technology-Specific Programs and Schools			288 / 934

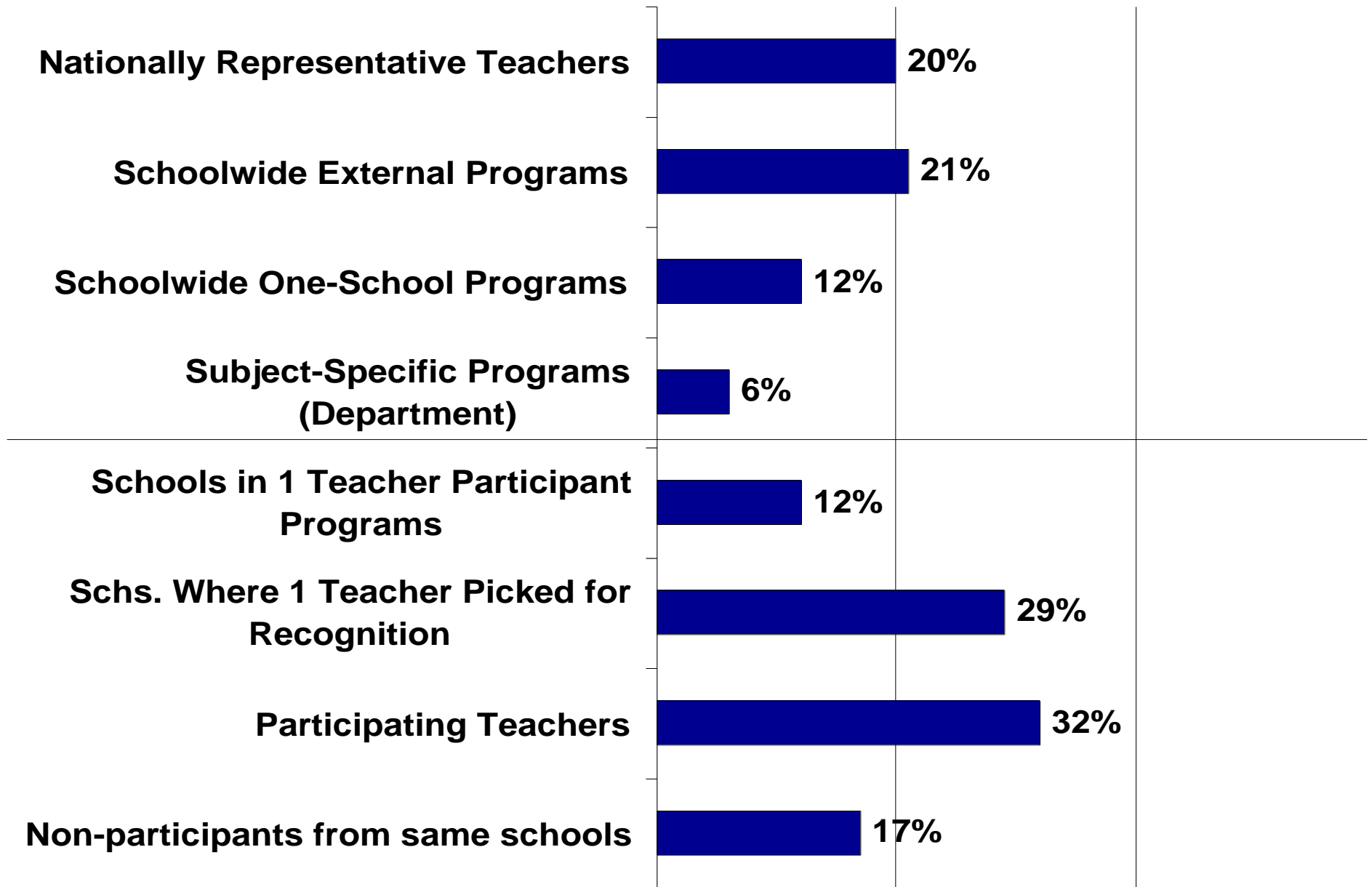
*Out of the 329 responding teachers at reform/recognition programs based around individual teacher participants, 55 teachers were actual participants; the others were other teachers at the same schools.

Technology-Oriented Programs and Schools

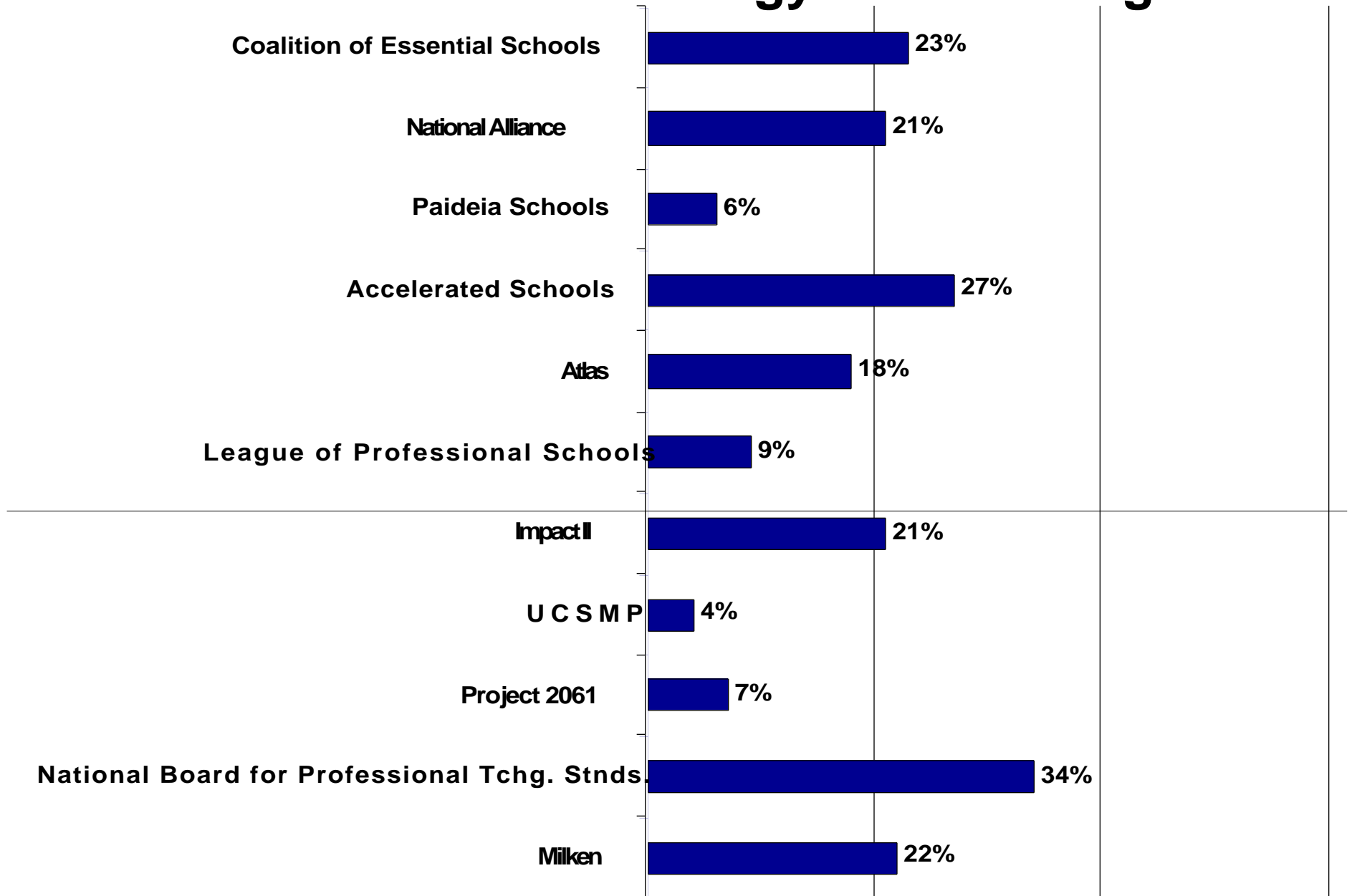
Nature of Entity	Program Participation at What Level	Programs or other Sources/ Number of programs participating	Schools Participating/ Completed Surveys
Technology-Embedded Reform Programs	School-wide	Co-NECT Schools, Schools for Thought, National School Network (BBN) / Total = 4 programs	28 / 94
	Individual teacher participants	Co-VIS, Global Lab, GLOBE, Learning Circles / Total = 9 programs	62 / 208**
High-End Technology Schools (no program)	School-wide emphasis on reform	Bozeman "Best Practices", Electronic Learning, "Kids on the Web", Web66 / NA	52 / 161
	Individual teacher tech reform program	Serim, "NetLearning"; Technology & Learning magazine / NA	20 / 73**
	Not a particular reform emphasis – just high-tech	QED Technology Presence Index, Clement's List / NA	110 / 362
Subtotal: Technology-Oriented Programs and Schools			272 / 898
Grand Total: Purposive Sample			560 / 1832

** Out of the 281 teacher respondents at schools with technology-specific programs or emphases, 52 were actual teacher participants identified through sources; the others were other teachers at the same schools.

% of Teachers Using Projects in Schools Doing *Non-Technology* Reform

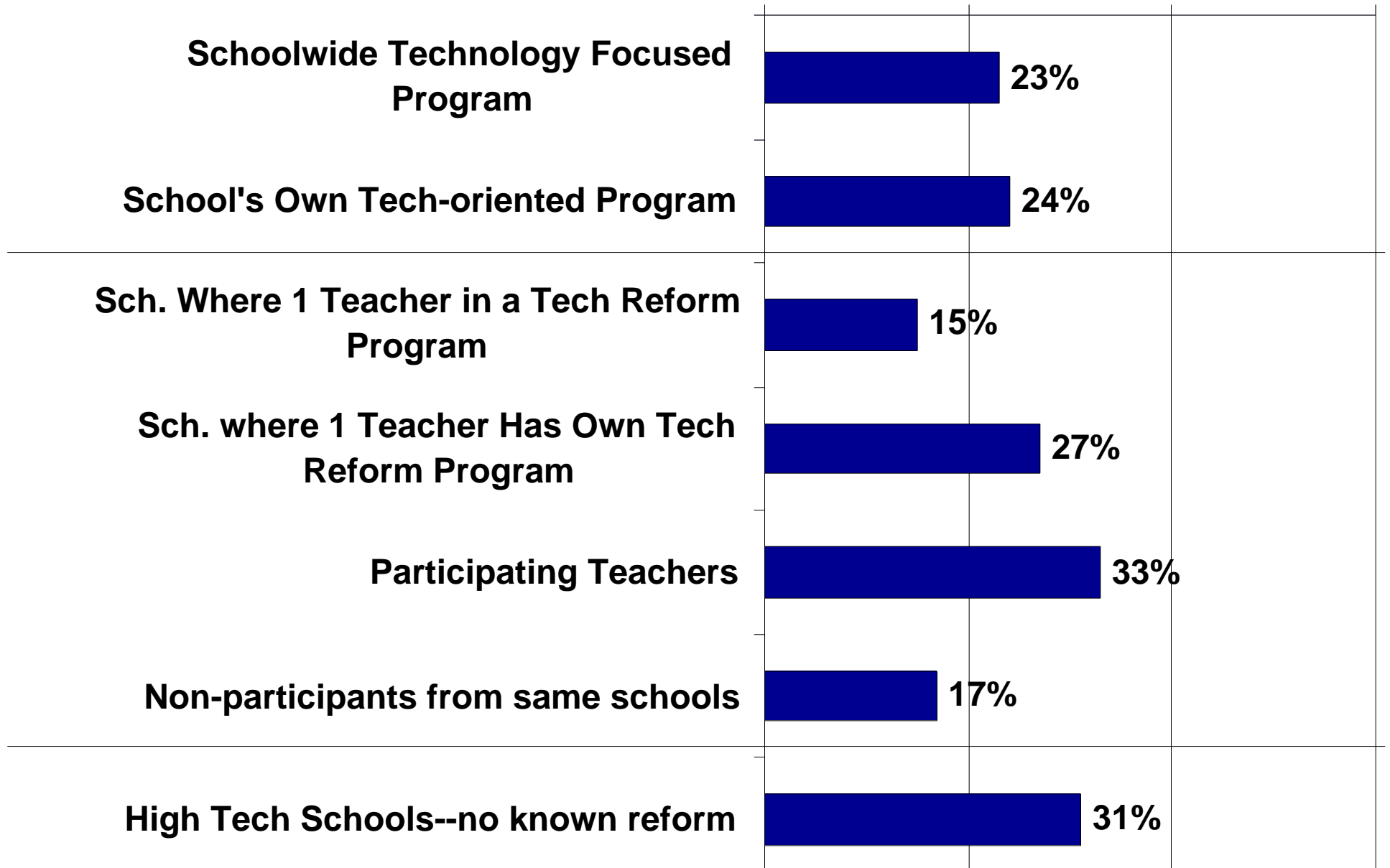


% of Teachers Using Projects in Selected *Non-Technology* Reform Programs

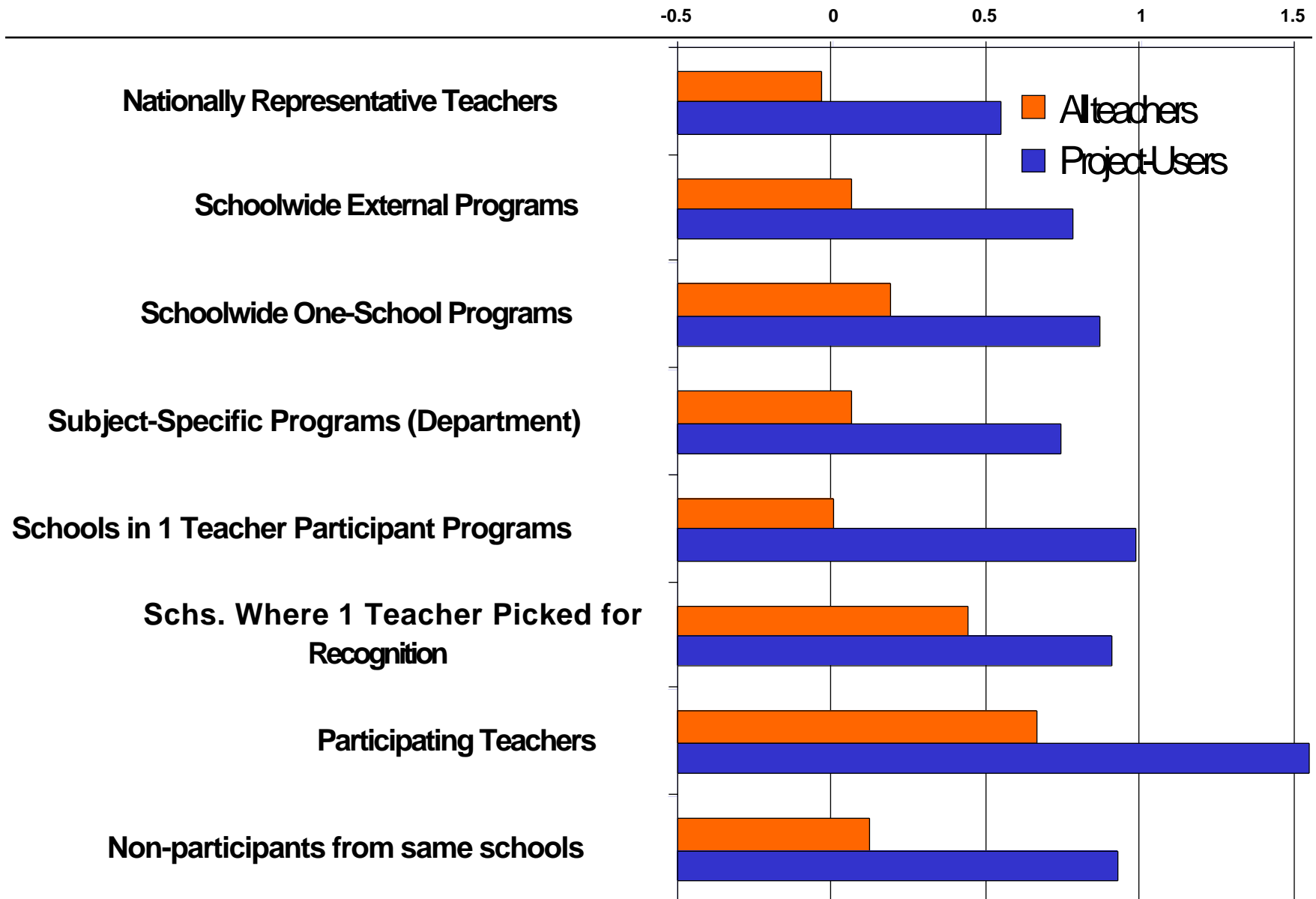


% of Teachers Using Projects in Technology-Oriented Schools

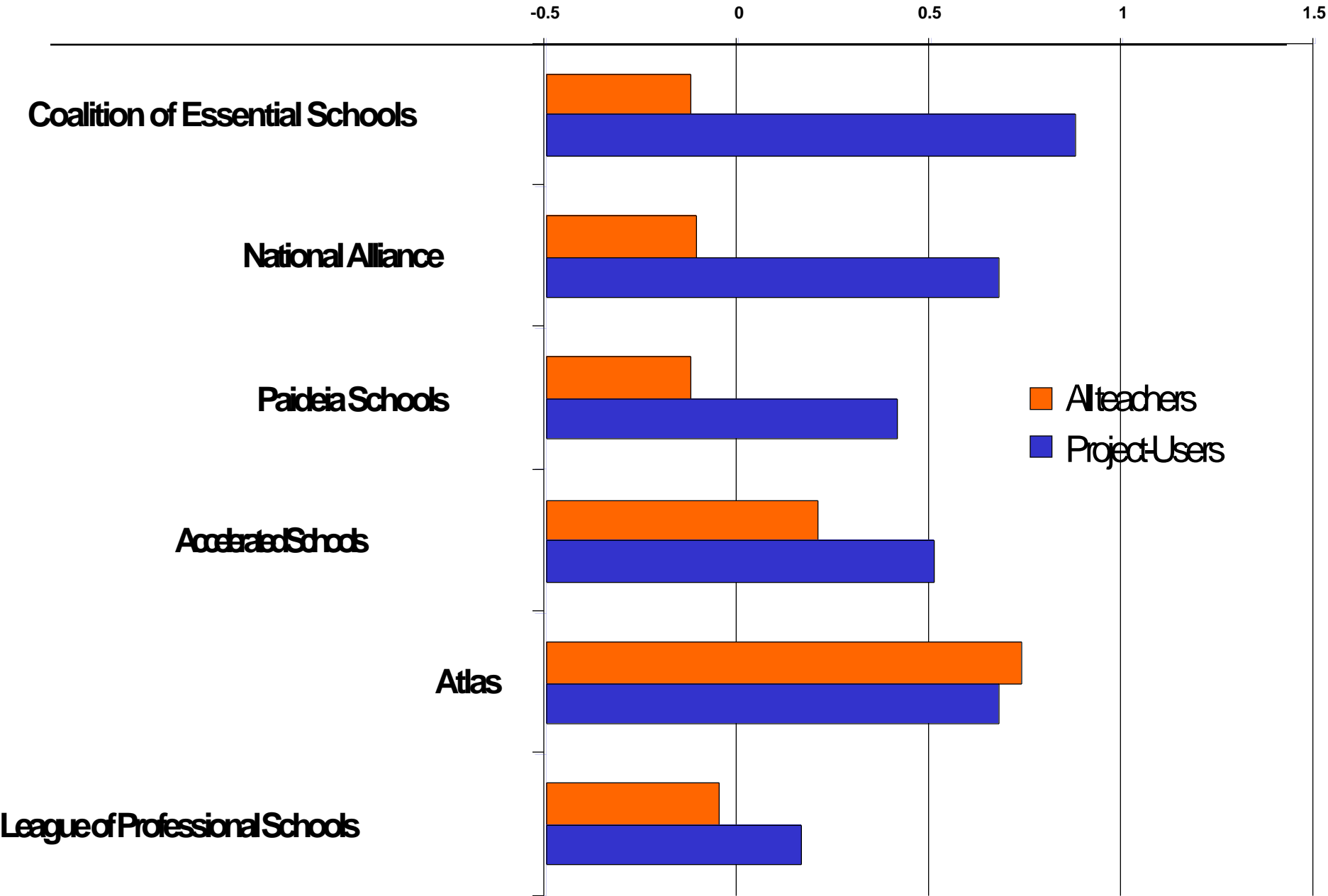
0% 20% 40% 60%



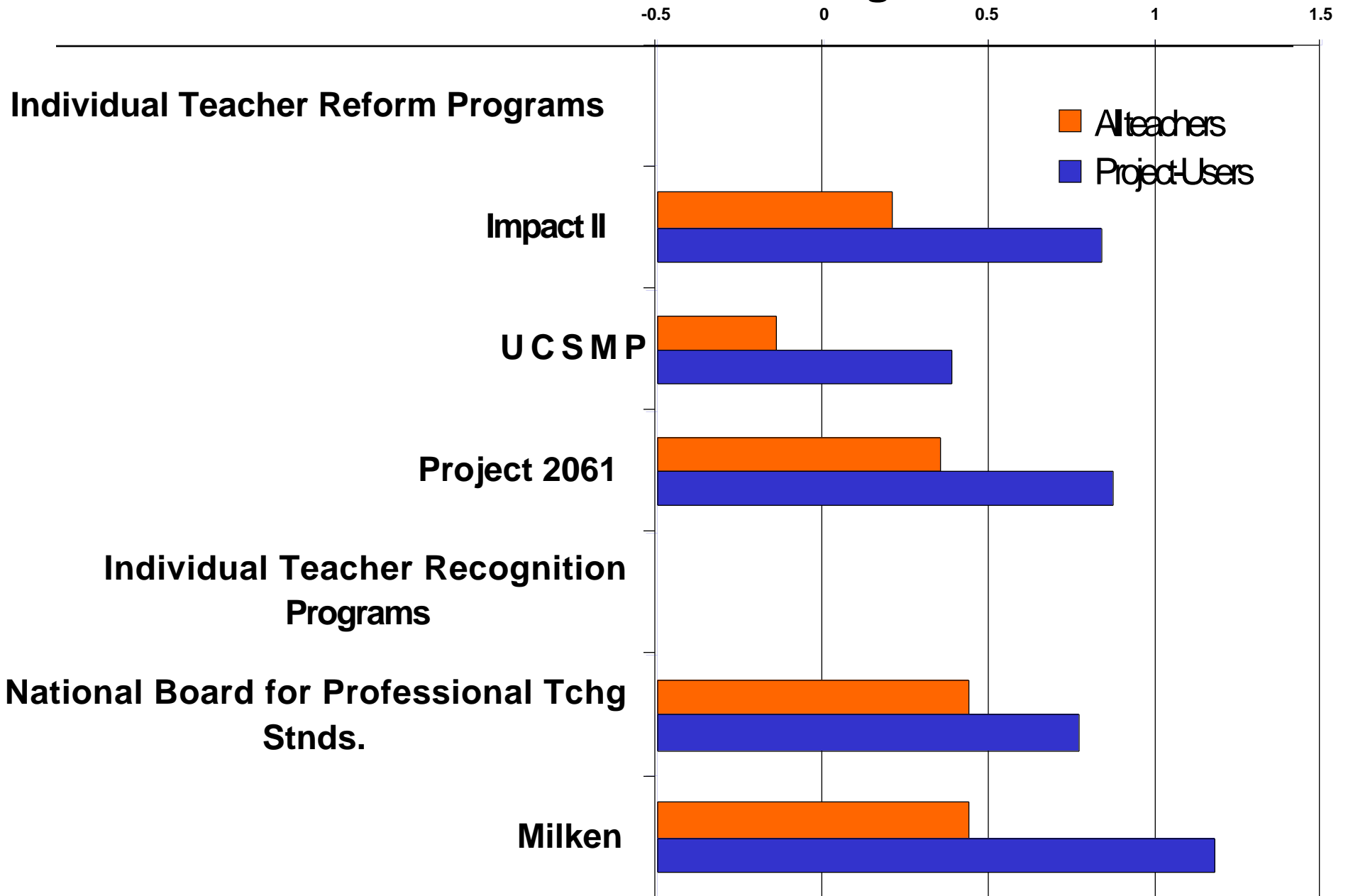
Cognitive Challenge in Non-Tech Reforming Schools



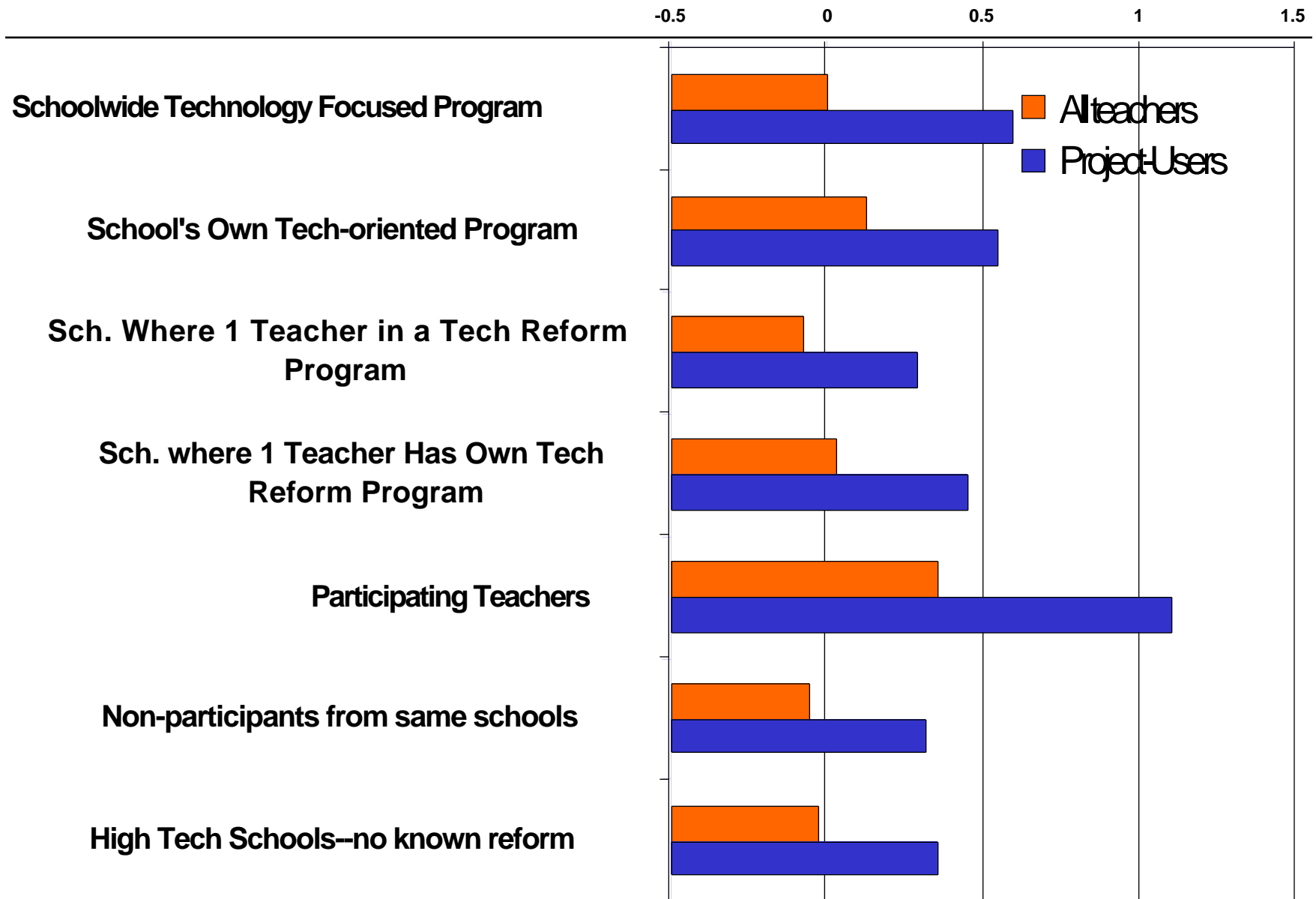
Cognitive Challenge in Schoolwide Non-Tech Programs



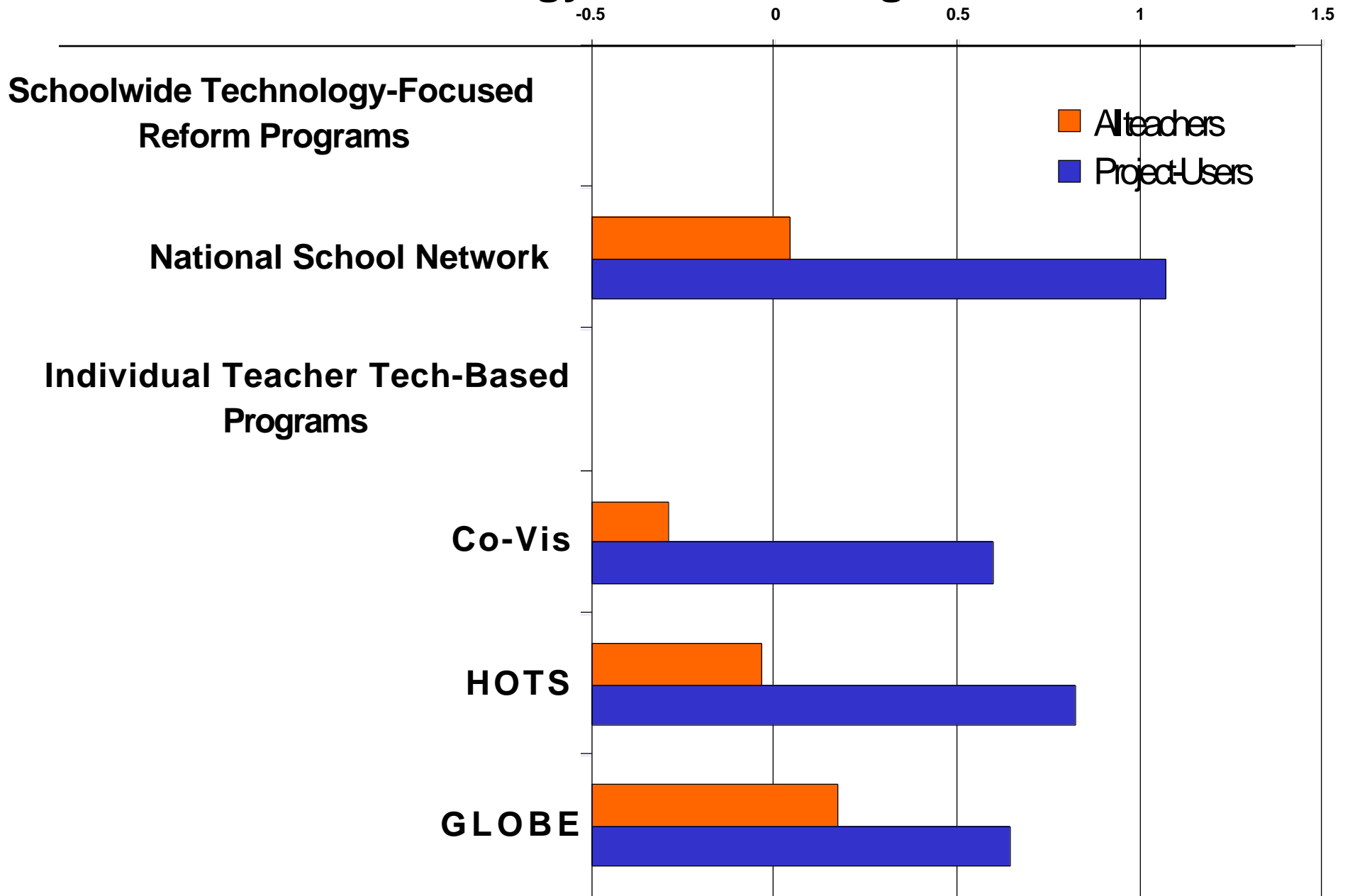
Cognitive Challenge in Schools with Individual Non-Tech Programs



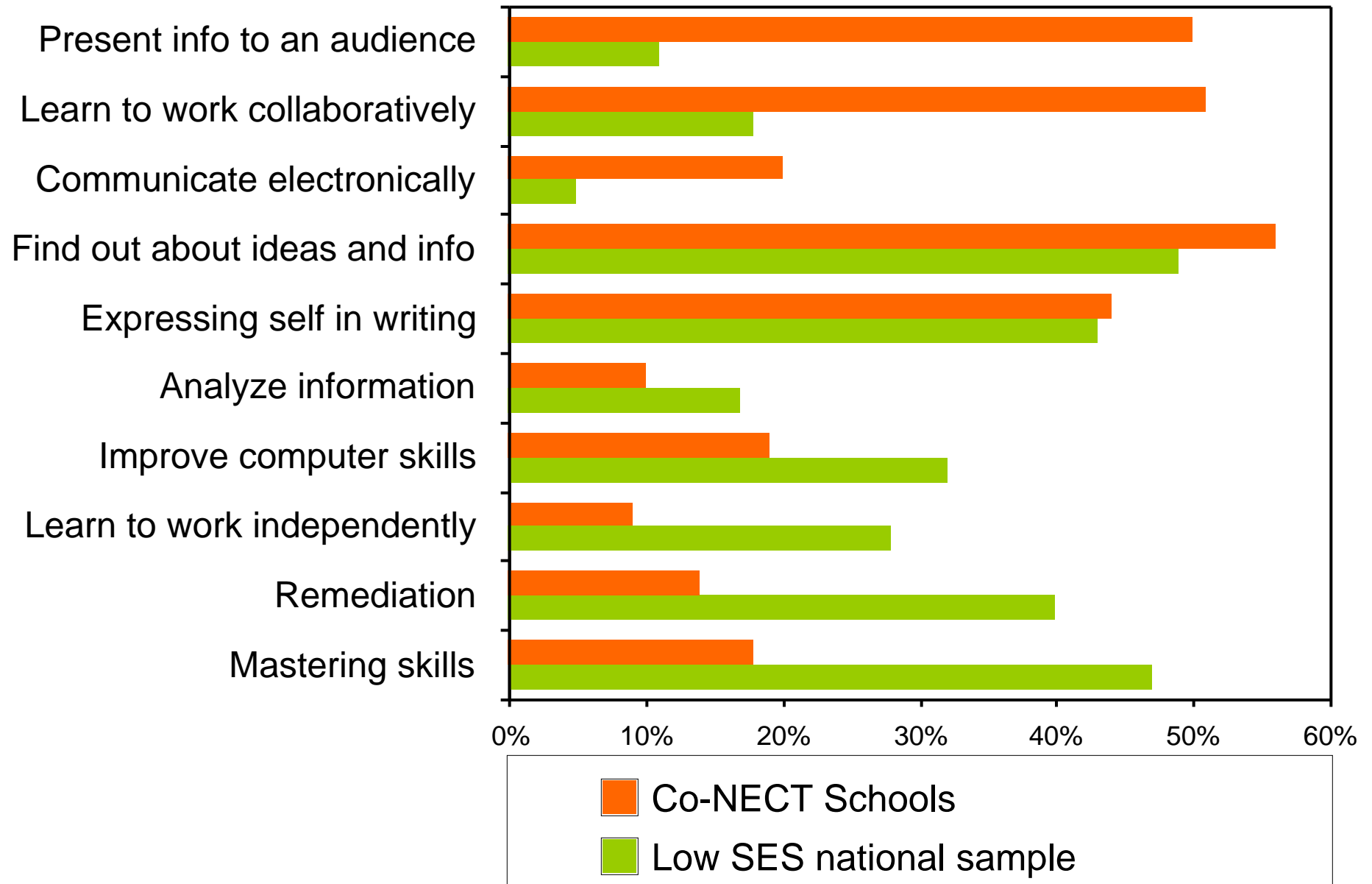
Cognitive Challenge in Technology-Oriented Schools



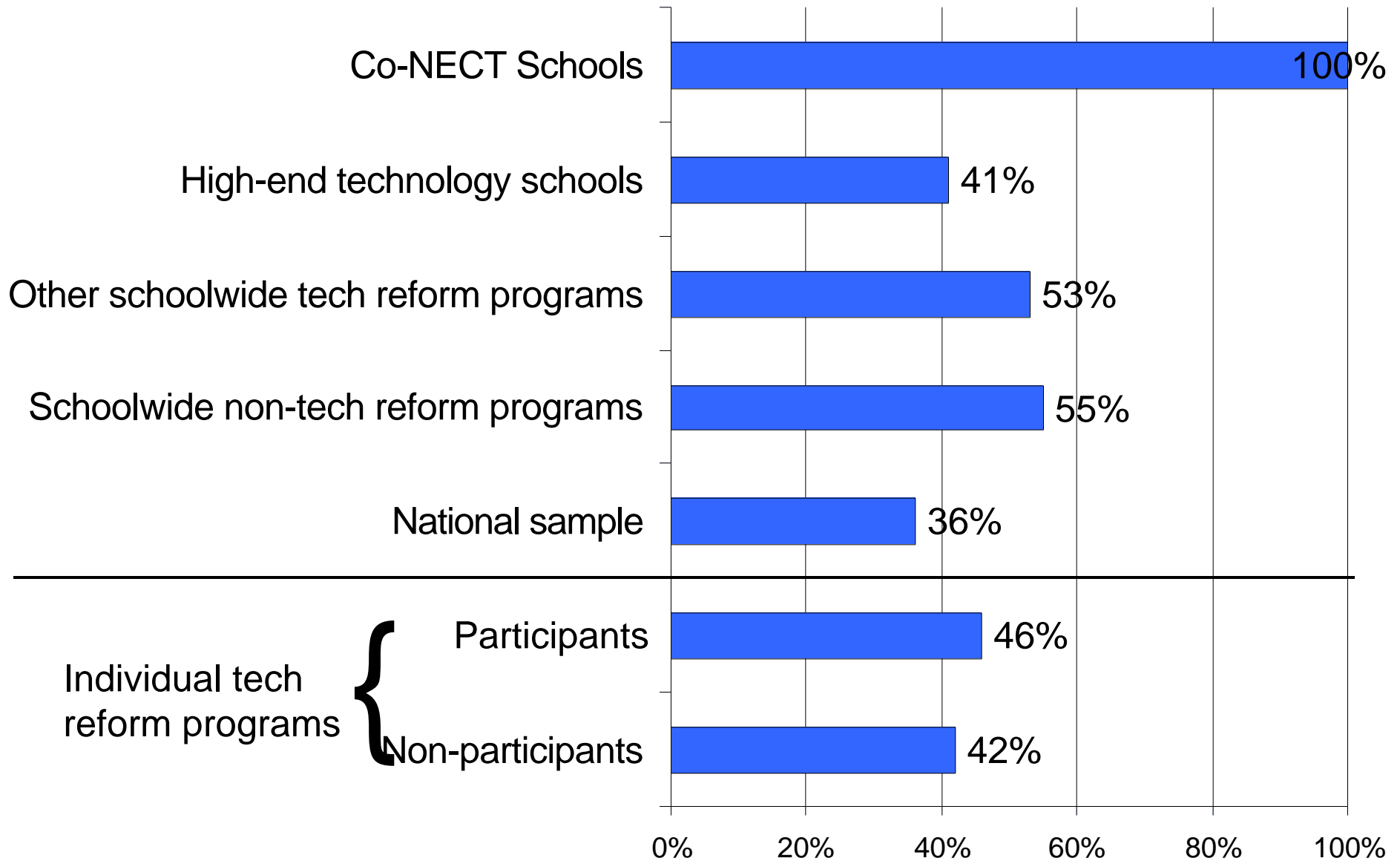
Cognitive Challenge in Schools with Technology-Oriented Programs



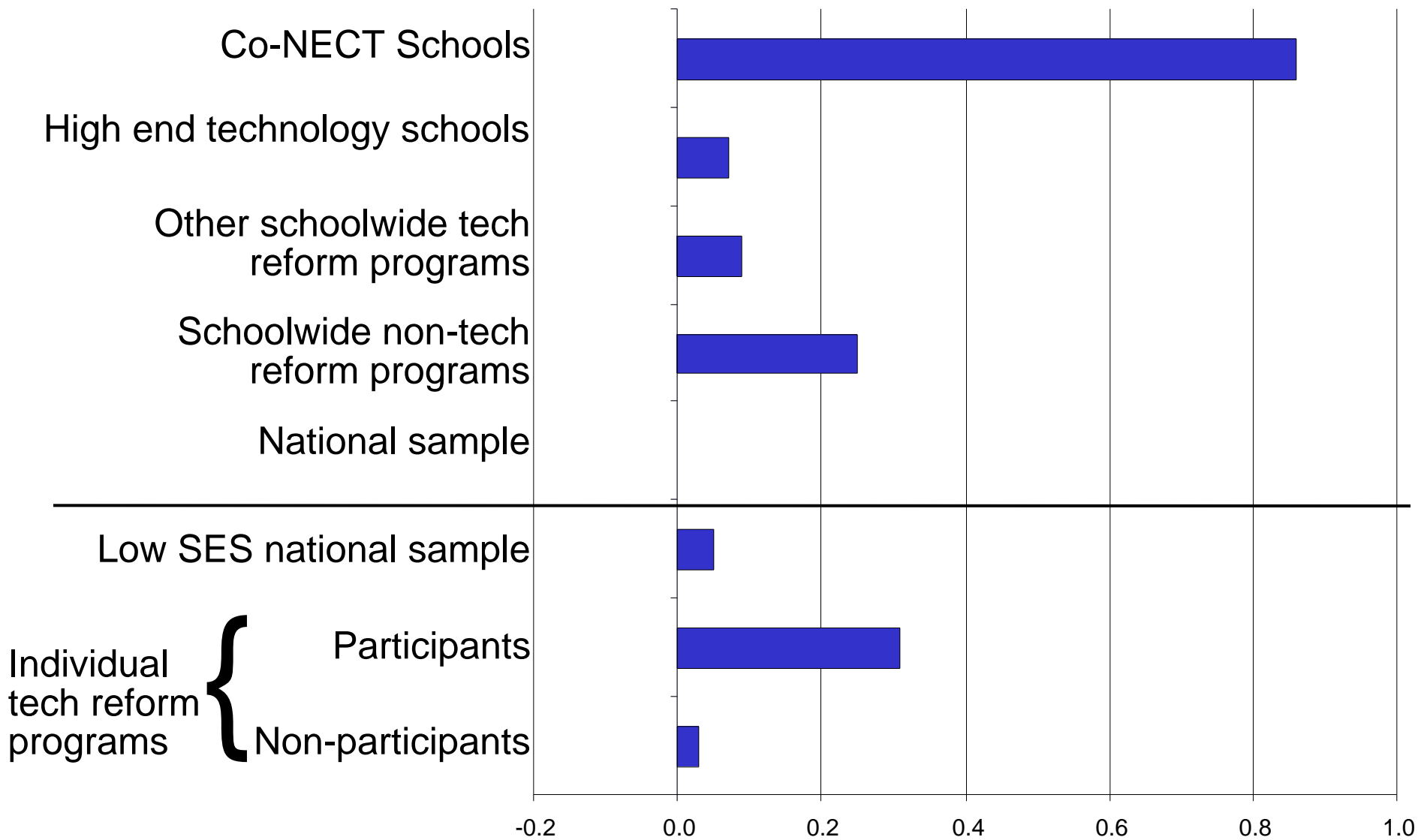
Main Objectives: Comparison Between Co-NECT Teachers and National Sample in Low-SES Schools



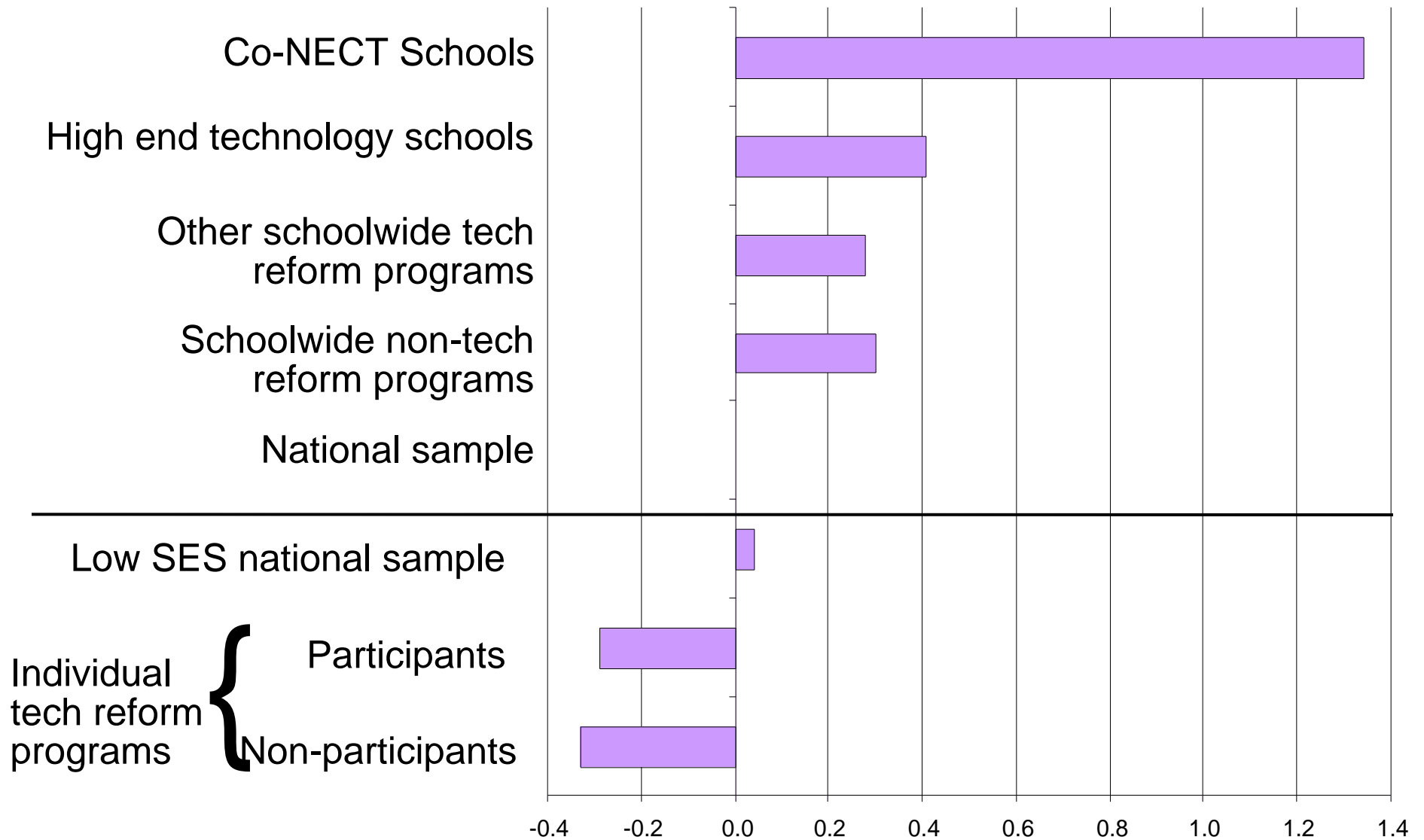
Percent of Teachers Who Have Students Work On Long Projects: More Often Now Than 3 Years Ago



Mutual Classroom Observation Compared to the National Sample



Professionalism of School Culture Compared to the National Sample



For More Information visit our Research Project Web Site:

www.crito.uci.edu/TLC

- New findings presented weekly
- Discussion group
- Reports and newsletters: view or download
- Archive of previous newsletters and findings