

## **Issues Influencing Teachers' Beliefs about Use of Critical-Thinking Activities with Low-Advantage Learners**

**By Bruce Torff & David Sessions**

Few issues on the educational scene have proven as vexatious as the achievement gap between the haves and have nots in our society. The achievement gap has proven both substantial and persistent despite the good intentions and considerable efforts of thousands of educators and notwithstanding the *No Child Left Behind* Act and other reform initiatives. Numerous factors associated with this predicament have been suggested. For example, Barton (2004) identified 14 factors correlated with

school achievement, including six in-school factors (rigor of curriculum, teacher experience and attendance, teacher preparation, class size, technology-assisted instruction, and school safety) and eight conditions outside of school (birth weight, lead poisoning, hunger and nutrition, reading to young children, television watching, parent availability, student mobility, and parent participation).

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It is fitting that this list is headed by rigor of curriculum, since the problem of "dumbed-down" teaching for low-advantage learners has been widely decried (e.g., Aronson, 2004; Delpit, 1996; Lands-

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man, 2004; Oakes, 1990; Page, 1990; Popham, 2004). There are many possible contributors to this rigor gap, including teachers' beliefs about what kind of teaching works best for different learner populations (i.e., learners that vary in SES advantages). Teachers have considerable latitude concerning the level of academic rigor in schools, making them a propitious group to consult on issues of beliefs about appropriate instruction. Although teachers' beliefs are imperfect indicators of classroom behavior (Fang, 1996), there can be little doubt that teachers' beliefs about learning and teaching influence classroom practice (Anning, 1988; Calderhead, 1996; Fenstermacher, 1994; Hollingsworth, 1989; Nespor, 1987; Pajares, 1992; Putman & Borko, 1997, 2000; Richardson, 1994, 1996; Smylie, 1988).

A subset of theory and research on teachers' beliefs focuses on *critical thinking*: cognitive skills and strategies that increase the likelihood of a desired outcome—thinking that is purposeful, reasoned, and goal-directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions (Halpern, 2003, p. 6). Critical-thinking (CT) challenges are a central component of rigorous classroom instruction (Brown & Campione, 1990; Browne & Keeley, 2001; Ennis, 1987; Henderson, 2001; Kuhn, 1999; Perkins, Jay, & Tishman, 1993; Pogrow, 1990, 1994; Raths et al., 1986; Resnick, 1987; Torff, 2003; White & Fredrikson, 1998). CT skills seem all the more vital now that high-stakes tests increasingly include CT-oriented tasks such as essay writing (Yeh, 2002). For example, in New York State, a recent high school exit examination in biology required learners to write essays describing an experimental design that would test a particular claim—an assignment that asks learners not merely to recall scientific knowledge, but also to reason as scientists do.

Theory and research on teachers' CT-related beliefs have included the assertion that these beliefs are associated with their perceptions of learners' SES advantages—a variable highly correlated with academic achievement and track assignment. The hypothesis is that teachers judge activities with a high level of CT (e.g., debate, discovery learning) more suitable for high-advantage learners, whereas activities with a low level of CT (e.g., lecture, drill and practice) are deemed more appropriate for low-advantage learners (Pogrow, 1990, 1994; Raudenbush, Rowan, & Cheong, 1993; Torff, 2006; Torff & Warburton, 2005; Warburton & Torff, 2005; Zohar, Degani, & Vaakin, 2001; Zohar & Dori, 2003). Evidence documenting such predilections would suggest that teachers tend to differentiate instruction based on perceived learner advantages in ways that may hinder the academic progress of low-advantage learners.

The first study focused on teachers' beliefs about use of high-CT activities for low-advantage learners was conducted by Raudenbush et al. (1993). The researchers administered specially designed scales that assessed the extent to which 303 secondary teachers in California and Michigan emphasized high-CT instruction in upper-track and lower-track classes. The sampled teachers were significantly less likely to focus on high-CT activities in lower-track classes, particularly in math and science. Similar results were obtained by Zohar et al. (2001), who conducted 40

semi-structured interviews in which teachers in Israel discussed their instructional goals for learners identified by the researchers as low-achieving or high-achieving. Almost half the teachers judged high-CT activities to be inappropriate for low-achieving learners. These results provide evidence of an *advantage effect* in teachers' beliefs about high-CT activities (with advantage defined as an indication of socioeconomic status, a variable highly correlated with academic achievement and track assignment).

To further explore such effects, a new scale was designed to tap teachers' beliefs about the effectiveness of high-CT and low-CT activities for high-advantage and low-advantage populations (for validation data see Torff & Warburton, 2005). In three studies ( $N = 145$ , 103, and 102, respectively), the *Critical Thinking Belief Appraisal* (CTBA) was administered to 350 secondary teachers in New York State, Connecticut, and South Carolina (Torff, 2006; Warburton & Torff, 2005). Results showed that teachers produced large advantage effects for both low-CT activities (eta-squared effect sizes of .53, .48, and .52, respectively) and high-CT activities (.63, .58, and .68).

Teachers in these three studies also produced *pedagogical-preference effects* in which high-CT activities were rated as significantly more effective than low-CT ones for both high- and low-advantage learners. For the high-advantage population, moderate to small pedagogical-preference effect sizes of .24, .20, and .08 were obtained. For low-advantage learners, the effect was weaker and less consistent: in the initial study, the effect size was .09; a subsequent study produced an effect size of .05; and a third study found no significant effect. In general, the results reveal small but significant pedagogical-preference effects favoring high-CT activities for both learner populations, and results as such are inconsistent with the claim that teachers judge low-CT activities to be preferable to high-CT ones for teaching low-advantage learners.

But neither did the results suggest that teachers believed that high- and low-advantage learners should receive similar access to high-CT activities. The advantage effect was stronger for high-CT activities than low-CT ones, and the pedagogical-preference effect was stronger and more consistent for high-advantage learners than low-advantage ones. Teachers preferred high-CT activities to low-CT ones for all learners, but still deemed it appropriate that low-advantage learners receive instruction that is shorter on high-CT activities and longer on low-CT ones (relative to their high-advantage peers).

This pattern in teachers' beliefs may not be optimal, at least in comparison to the beliefs of expert teachers. A study was conducted employing the CTBA to compare the beliefs of supervisor-nominated expert teachers with randomly selected inservice teachers ( $N = 202$ ) in New York State (Torff, 2006). Relative to randomly selected teachers, experts were more supportive of high-CT activities, less supportive of low-CT ones, and less inclined to differentiate use of high-CT and low-CT activities based on learner advantages. These findings suggest that teacher-

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education initiatives are needed to promote appropriate belief change concerning high-CT and low-CT instruction for different learner populations, with emphasis on high-CT activities for low-advantage learners.

### **Research Question**

In the research summarized above, teachers judged it prudent to support high-CT activities more with high- than low-advantage learners and low-CT activities more for low- than high-advantage learners. But which specific issues do teachers take into account in deciding whether to use high-CT or low-CT activities with low-advantage learners? It seems plausible that teachers' predilections might be associated with issues such as learners' level of prior knowledge, or contextual factors such as support from administrators, or the burgeoning influence of standards and tests. Research identifying the specific issues that figure in teachers' CT-related beliefs has potential to inform teacher-education practices designed to promote unbiased use of CT activities in schools. In this article we report the results of research conducted to identify issues that teachers take into account in deciding when to use high-CT or low-CT activities with low-advantage learners. In preliminary research, interviews with teachers were conducted to identify candidate issues. These issues were then further examined in survey research with a larger group of teachers.

### **Preliminary Research**

#### ***Method***

Participants in the preliminary phase included 20 social studies teachers employed at 20 different secondary schools. The 12 high schools and 8 middle schools were chosen at random from a list of all secondary schools on Long Island, New York. Participating teachers were randomly selected from lists of faculty at each school. The 13 women and 7 men had a mean age of 35.5 years with ages ranging from 26 to 57 years. Teaching experience ranged from 3 years to 22 years with a mean of 7.6 years. Eighteen of 20 had completed a master's degree or a master's plus thirty credit, and none held a doctoral degree.

Research assistants conducted interviews with individual teachers at the schools at which the teachers were employed. Teachers were not compensated for participating and were told that all responses were confidential. All interviews were recorded and transcribed. Participants were asked to review and comment on two short descriptions of lessons in social studies (prompts) taken from the CTBA, especially in terms of how useful these lessons would be for teaching low-advantage learners (with advantage defined as an indication of socioeconomic status). One prompt described a lesson requiring a high level of CT (high-CT), and the other described a lesson requiring a low level of CT (low-CT), as shown in Figure 1. These prompts evinced satisfactory theoretical and methodological utility in validation

research (Torff & Warburton, 2005). Participants were asked to respond to such questions as: to what extent is this activity effective for teaching low-advantage learners, and why? What factors influence your decisions to use or avoid this kind of activity with low-advantage learners? And why is this activity more (or less) appropriate for low-advantage learners than high-advantage ones?

### **Results**

The teachers interviewed were highly forthcoming with comments about the prompts and appeared to have little difficulty responding to them. When teachers were asked to discuss the effectiveness of each prompt for low-advantage learners, eleven specific issues emerged (listed alphabetically).

- ◆ *Classroom management.* In reference to the high-CT prompt, a teacher said, "you risk chaos; [low-advantage learners] can't sit still through this."
- ◆ *Ease of assessment.* Several teachers described the high-CT prompt as producing student work that is "hard to grade."
- ◆ *High-stakes tests.* Referring to the high-CT prompt, a teacher said, "I can't do a lesson like this with [high-stakes tests] coming up."
- ◆ *Influence of administrators.* In reference to the low-CT prompt, a teacher said, "my principal does not like this kind of teaching."
- ◆ *Influence of colleagues.* Referring to the high-CT prompt, a teacher said, "this is the sort of lesson teachers do a lot of around here."
- ◆ *Influence of parents.* In reference to the low-CT prompt, a teacher said, "This is how [parents] want me to teach."
- ◆ *Learners' level of ability.* Referring to the high-CT prompt, a teacher said that low-advantage learners "just don't have what it takes, intellectually, to learn from this lesson."
- ◆ *Learners' level of motivation.* In reference to the high-CT prompt, a teacher remarked that low-advantage learners "have to want to participate in something like this, and they usually don't."
- ◆ *Learners' level of prior knowledge.* Referring to the low-CT prompt, a teacher said, "When [low-advantage learners] don't know anything about what you are teaching, this is what you have to do."
- ◆ *The nature of the subject.* According to one teacher, "history has a lot of names and dates, and [the high-CT prompt] doesn't cover them."
- ◆ *Time constraints.* One teacher responded to the high-CT prompt by saying, "This takes so long I can't do it very often."

Each of these issues was coded on five or more of the 20 interview transcripts

and thus was selected for further analysis in the survey phase. Although interview data cannot be used to assess the frequency of a response, the consistency with which teachers responded increases the confidence that can be placed in the importance of the eleven issues in teachers' beliefs concerning use of high-CT and low-CT activities with low-advantage learners.

## **Survey Research**

### **Method**

The goal of the survey phase was to determine the extent to which the eleven issues identified in the preliminary phase influence the beliefs of a larger sample of social studies teachers ( $N = 120$ ). The teachers were selected at random from lists of faculty at 60 randomly selected middle schools and high schools, with two teachers selected at each school. With random selection of schools, it is unlikely that the sample includes disproportionate representation in terms of students' or teachers' racial, ethnic, or SES background. Participants were employed in New York, Connecticut, and Massachusetts—three states with detailed standards of learning in social studies and high-stakes examinations to assess student performance vis-à-vis these standards. The 52 men and 69 women had a mean age of 36.98 years. Teaching experience ranged from 1 to 40 years with a mean of 10.21. In educational attainment, 33 (27.3%) held a bachelor's degree, 52 (43%) held a master's degree, 35 (28.9%) held a master's degree plus thirty credits, and one (.8%) held a doctoral degree.

The two prompts taken from the CTBA for use in the preliminary phase were employed in the instrument used in this study (Figure 1). Following each prompt were eleven items—six-point likert-type scales asking respondents to rate their level of agreement with a sentence describing one of the eleven issues described above. For example, the issue *learners' level of ability* was described in the statement, "Low-advantage learners have sufficient academic ability to participate successfully in the activity." Ratings were made with the following scale: 6=strongly agree; 5=agree; 4=agree more than disagree; 3=disagree more than agree; 2=disagree; and 1=strongly disagree.

To reduce the potential for response bias, four forms of the survey were created. In two of the forms, the high-CT prompt was presented first followed by the low-CT prompt, and in the other two forms the order was opposite. Moreover, in each form, half of the items were worded for reverse scoring; for example, the reversed wording for the issue *learners' level of ability* is "Low-advantage learners lack the academic ability to participate successfully in the activity." In two of the forms the even-numbered items were reversed, and in the other two forms the odd-numbered items were reversed. These procedures reduce bias that may be caused by ordinal effects or language used in item reversal.

Respondents completed the survey at the schools at which they were employed.

Figure 1: Survey Instrument (Form A)

1. A Social Studies class is studying the Treaty of Versailles signed at the end of World War I. The teacher assigns students to write "letters from the future" to President Wilson arguing why the United States should or should not support the treaty.

- (1) Low-advantage students lack the academic ability to participate successfully in this activity.
- (2) Parents would be supportive of this activity for low-advantage students.
- (3) This activity poorly prepares low-advantage students for high-stakes tests.
- (4) This activity is not too time-consuming in the classroom to be used with low-advantage students.
- (5) The teachers I work with would not use this activity with low advantage students.
- (6) Low-advantage students have sufficient motivation to participate successfully in this activity.
- (7) In this subject (Social Studies), this is not the kind of activity that works well with low-advantage students.
- (8) Classroom management problems are not likely to arise should low-advantage students be given this activity.
- (9) This activity would be difficult to assess if given to low-advantage students.
- (10) Low-advantage students have sufficient prior knowledge to participate successfully in this activity.
- (11) Administrators would not support this activity for low-advantage students.

2. A Social Studies class is studying the industrial revolution. The teacher provides students with a list of inventions, explains the impact of these inventions during this period, and describes how they continue to influence the modern world.

- (1) Low-advantage students have sufficient academic ability to participate successfully in this activity.
- (2) Parents would not be supportive of this activity for low-advantage students.
- (3) This activity effectively prepares low-advantage students for high-stakes tests.
- (4) This activity is too time-consuming in the classroom to be used with low-advantage students.
- (5) The teachers I work with would use this activity with low advantage students.
- (6) Low-advantage students lack the motivation to participate successfully in this activity.
- (7) In this subject (Social Studies), this is the kind of activity that works well with low-advantage students.
- (8) Classroom management problems are likely to arise should low-advantage students be given this activity.
- (9) This activity would be easy to assess if given to low-advantage students.
- (10) Low-advantage students lack the prior knowledge needed to participate successfully in this activity.
- (11) Administrators would support this activity for low-advantage students

*Note:* For prompt #1, even-numbered items are worded for reverse scoring; for prompt #2, odd-numbered items are worded for reverse scoring. Respondents were told that "low-advantage" was defined as low in SES. Respondents were asked to rate their level of agreement with each statement using the following scale: 6 = strongly agree; 5 = agree; 4 = agree more than disagree; 3 = disagree more than agree; 2 = disagree; and 1 = strongly disagree.

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No teachers asked to participate declined to do so. They received instructions indicating that *disadvantage* was defined as a measure of SES, this opinion survey had no correct answers, and all responses were confidential.

In this study the eleven candidate issues served as dependent variables. In addition, four independent variables were employed as covariate measures. The two continuous independent variables were age and teaching experience (each measured in years). The two categorical independent variables were gender and educational attainment (bachelor's, master's, master's plus 30 credits, doctorate). Using SAS (version 9.1), within-participants MANCOVA procedures were performed to determine (a) which issues were associated with a statistically significant pedagogical-preference effect (i.e., a difference between the high-CT prompt and the low-CT one for a given issue) and (b) the effect size of any such effects.

### **Results**

Evaluation of assumptions of normality of sampling distributions, linearity, and homogeneity of variance/covariance matrices were satisfactory. There were no outliers at  $\alpha = .001$ . With the use of Wilks' Lambda, significant group differences were found for the combined dependent variables [ $F(11,94) = 9.55, p < .001$ ; eta-squared = .53]. No statistically significant main effects or interactions were found between the covariates and the dependent variables, suggesting that participating teachers' beliefs about appropriate pedagogy for low-advantage learners was largely independent of age, teaching experience, gender, and educational attainment. No statistically significant interactions were found among the dependent variables—an indication that these variables did not interact extensively to influence teachers' pedagogical decisions.

Post hoc univariate analyses were performed using the Bonferroni method ( $p < .05$ ). For two of the candidate issues, *classroom management* and *ease of assessment*, no significant differences were found between the high-CT and low-CT activities, indicating that these issues had little influence on teachers' decision-making concerning use of these activities with low-advantage learners. The remaining nine candidate issues were divided between (a) issues associated with a pedagogical-preference effect favoring high-CT activities and (b) issues associated with a pedagogical-preference effect favoring low-CT activities (See Table 1).

Three issues were associated with a pedagogical-preference effect favoring high-CT activities over low-CT ones for low-advantage learners. These issues included *high-stakes tests* (partial eta-squared = .12), *influence of administrators* (.09), and *nature of the subject* (social studies) (.05). Weak effects are indicated by these small partial eta-squared statistics.

Six issues were associated with a pedagogical-preference effect in which teachers favored low-CT activities over high-CT ones for low-advantage learners. Among these issues were *learners' level of prior knowledge* (.15), *time constraints* (.13), *influence of parents* (.08), *influence of colleagues* (.08), *learners' level of*



Table 1. Effect Sizes for Significance Tests of Inservice Teachers' Within-Participants Differences in Issues Associated with Pedagogical-Preference Effects for Low-Advantage Learners

Issue	Eta
Issues not associated with pedagogical preferences:	
Classroom management	n.s.
Ease of assessment	n.s.
Issues associated with preference for high-CT activities:	
High-stakes tests	.12
Influence of administrators	.09
Nature of the subject (social studies)	.05
Issues associated with preference for low-CT activities:	
Learners' prior knowledge	.15
Time constraints	.13
Influence of parents	.08
Influence of colleagues	.08
Learners' level of motivation	.07
Learners' level of ability	.04

Note. n.s. = not significant; eta = partial eta-squared statistic derived from on post hoc univariate analysis using the Bonferroni method ( $p < .05$ ) based on MANOVA performed on combined dependent variables [ $F(11,94) = 9.55, p < .001$ ; eta-squared = .53].

motivation (.07) and learners' level of ability (.04). These small partial eta-squared statistics indicate weak effects.

## Discussion

The goal of this research was to investigate the issues that prompt teachers to favor low-CT activities over high-CT ones when teaching low-advantage learners—a topic germane to the problem of diminished rigor of curriculum provided to low-advantage learners, which has been linked to persistent achievement gaps between high- and low-advantage learners in our society. In preliminary research, interviews with 20 social studies teachers yielded 11 issues they discussed as relevant to their preferences for classroom use of high-CT or low-CT activities. These issues were then incorporated into a survey instrument administered to 120 teachers.

In the resulting data analysis, nine of 11 candidate issues were associated with statistically significant pedagogical-preference effects, but the effect sizes were small. No single issue or small cluster of issues dominated teachers' thinking concerning appropriate use of high-CT and low-CT activities for low-advantage learners. Rather, a complex calculation involving multiple issues appeared to underlie teachers' beliefs. Some issues had little apparent effect on teachers' beliefs, other issues were associated with a preference for high-CT activities over low-CT ones, and still other issues seem to have prompted teachers to prefer low-CT activities over high-CT ones.

These data make it possible to frame an account of the conditions under which

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teachers favored high-CT activities or low-CT ones for teaching low-advantage learners. A pedagogical-preference effect in which teachers favored high-CT activities over low-CT ones was associated with the issues *high-stakes tests*, *influence of administrators*, and *nature of the subject*. A pedagogical-preference effect in which teachers preferred low-CT activities over high-CT ones was associated with the issues *learners' level of prior knowledge*, *time constraints*, *influence of parents*, *influence of colleagues*, *learners' level of motivation*, and *learners' level of ability*.

Analysis of these issues individually delves more deeply into teachers' decision-making concerning classroom use of high-CT and low-CT activities. Starting with the issues that proved not to be associated with pedagogical-preference effects, if teachers in the survey phase judged high-CT activities more difficult to assess than low-CT activities, they did not allow these difficulties to influence their ratings of the effectiveness of these kinds of activities for low-advantage learners. If they had, the issue *ease of assessment* would have been associated with a pedagogical-preference effect favoring low-CT activities. Similarly, if teachers viewed the issue *classroom management* as more of a problem with high-CT activities than low-CT ones, they did not see fit to permit such problems to result in a pedagogical-preference effect favoring low-CT activities.

Concerning the issues associated with pedagogical-preference effects favoring high-CT activities, a result emerged that might appear somewhat surprising at first blush but seems less so in light of changes on the educational scene in the last decade. In years past it might have been expected that the influence of high-stakes testing would prompt teachers to produce pedagogical-preference effects favoring low-CT activities, since many teachers believed that promoting successful test performance required an approach heavy in factual-recall and drill-and-practice activities (Yeh, 2002). Such an approach seemed well suited to the multiple-choice format used almost exclusively on high-stakes tests for several decades.

But testing procedures have changed a great deal in recent years in many parts of the country. For example, many contemporary tests of social studies (including tests in the states in which this research took place) require learners to write essays in response to document-based questions. Such a task requires at least a modicum of critical thinking, not just fact recall. Evidently teachers who participated in the survey phase believed that preparation for the new testing format required a regimen of high-CT activities, since the issue *high-stakes tests* was associated with a pedagogical-preference effect favoring high-CT activities—not low-CT ones as might have been the case in the past. The effect of changing testing procedures on teachers' beliefs would seem to be an issue worthy of further study.

Two other issues were associated with a pedagogical-preference effect favoring high-CT activities. The issue *influence of administrators* was associated with a pedagogical-preference effect favoring high-CT activities—teachers apparently believed that administrators favored high-CT activities over low-CT ones. Simi-

larly, a pedagogical-preference effect was found concerning the issue *nature of the subject*, in this case social studies. This finding is likely to vary across subjects; for the social studies teachers who participated in this study, the nature of the subject indicates, if narrowly, that high-CT activities are preferable to low-CT ones.

Turning to the six issues associated with pedagogical-preference effects favoring low-CT activities, the issue *learners' level of prior knowledge* figured most heavily for teachers among the 11 candidate issues considered in this study. Teachers apparently believed that low-CT activities are appropriate for low-advantage learners when these learners have limited familiarity with the subject at hand. Another pedagogical-preference effect favoring low-CT activities was found concerning the issue of *time constraints*; when teachers perceived time to be running short, they judged it prudent to support fewer high-CT activities, which most educators regard as considerably more time-consuming than low-CT activities.

Two additional issues associated with pedagogical-preference effects favoring low-CT activities are suggestive of the influence of the community and peer group on teachers' decision making: *influence of parents* and *influence of colleagues*. Teachers apparently believed that a pedagogical-preference effect favoring low-CT activities was in keeping with beliefs held by parents and colleagues.

The two remaining issues associated with pedagogical-preference effects favoring low-CT activities involve the characteristics of learners. The first was *learners' level of motivation*—teachers apparently regarded low-CT activities as more effective than high-CT ones when learners were perceived to be comparatively unmotivated. The issue *learners' level of academic ability* was weakly associated with a pedagogical-preference effect favoring low-CT activities. It seems plausible that teachers might judge low-advantage learners to be simply unable to participate successfully in high-CT activities, resulting in a sizeable pedagogical-preference effect favoring low-CT activities. Such an effect was found, but it was quite small (.04), providing only weak support for the assertion that teachers prefer low-CT activities for low-advantage learners because they judge these learners unfit to handle the academic challenges inherent in high-CT activities (Aronson, 2004; Delpit, 1996; Pogrow 1990, 1994).

A number of limitations of this study should be noted. Studies involving teachers of other academic subjects may produce results that differ from those produced by this study's social-studies teachers. Similarly, studies of elementary or special-education teachers may yield different results. Finally, teachers in other geographical areas may have different beliefs relative to the teachers (from New York, Connecticut, and Massachusetts) who participated in this research.

### **Implications for Teacher Education**

For teacher educators interested in unbiased use of CT in schools, evidence that teachers hold beliefs likely to result in fewer high-CT activities for low-advantage

learners than high-advantage ones (and further evidence that expert teachers hold no such beliefs) seems to provide impetus for efforts to redress such inequities. A large body of literature is focused on strategies for facilitating change in teachers' beliefs (e.g., Blumenfeld et al., 1994; Calderhead, 1996; Feinman-Nemser et al., 1989; Hollingsworth, 1989; Holt-Reynolds, 2000; Morine Dersheimer, 1993; Nespor, 1987; Patrick & Pintrich, 2001; Putman & Borko, 2000; Richardson, 1990, 1994; Richardson & Placier, 2002). This literature does not include discussions specifically about CT-related beliefs, but many of the strategies described therein have potential for initiating change in such beliefs. These strategies, combined with the issues found in this study to be associated with pedagogical-preference effects favoring low-CT activities for low-advantage learners, have potential to form the basis for teacher-education interventions designed to promote appropriate belief change.

Between the two issues with the strongest association with a pedagogical-preference effect favoring low-CT activities, the issue *time constraints* seems the more problematic. If teachers feel they do not have time for high-CT activities, it seems difficult to persuade them that they do, given the widespread understanding (supported by both advocates and critics of CT in education) that high-CT activities are often considerably more time consuming than low-CT activities. Emphasizing that high-CT activities are worth the time they take seems prudent, perhaps in tandem with teacher-education practices in which teachers encounter the difficulties inherent in low-CT activities, which include low retention and inert knowledge (Lambert & McCombs, 1998; Richardson, 1997; Sykes & Bird, 1992; White & Fredrikson, 1998). The other issue with a strong association to a pedagogical-preference effect favoring low-CT activities, *learners' level of prior knowledge*, appears to be open to teacher-education initiatives focused on the value of discovery-learning activities with low-advantage populations. Encouraging teachers to reflect on models of such activities, especially vis-à-vis the importance of the CT they require, may well have the effect of making teachers less concerned about both the *learners' level of prior knowledge* and *time constraints* issues (Fendler, 2003; Richardson & Placier, 2002; Spaulding & Wilson, 2002).

The issue *influence of parents* seems well suited to teacher-education practices stressing effective communication with parents concerning the changing nature of educational assessment. Many parents recall the tests they themselves took, which are dissimilar to the tests now administered in many states and districts. Helping parents to understand modern assessment procedures may ameliorate, over the long run, teachers' concerns that high-CT activities lack the parental support to be prudent choices for classroom instruction. A similar conclusion holds for the issue *influence of colleagues*. If teachers are encouraged to become more supportive of high-CT activities and less supportive of low-CT ones when teaching low-advantage learners, the influence of colleagues on teachers' pedagogical decision making will tend to facilitate, not inhibit, appropriate use of high-CT activities.

The issue *learners' level of motivation* also was associated with a pedagogical-

preference effect favoring low-CT activities—apparently based on the belief that such activities require less in the way of learner motivation relative to high-CT activities. But with learners frequently invoking the term *boring* to describe low-CT activities, it is not clear that these activities are better suited to less motivated learners. Teacher educators might well provide models of high-CT activities implemented effectively in classrooms with comparatively unmotivated learners and to encourage teachers to reflect on the impact of both high-CT and low-CT activities for these learners. Similar modeling and reflection activities might be helpful in addressing the issue *learners' level of ability*.

Teacher-education practices that encourage reflection on the issues found in this study to be associated with a pedagogical-preference effect for low-advantage learners (favoring low-CT activities over high-CT ones) have potential to reduce differentiation of instruction based on perceived learner advantages. Such a reduction may work to ease the rigor gap, and in turn ameliorate persistent achievement gaps. Research on teachers' beliefs about CT activities has promise to inform teacher education practices, with the goal of preparing new teachers to give low-advantage learners every opportunity to succeed in school.

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