What Students Notice as Different Between Reform and Traditional Mathematics Programs

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Research on the impact of Standards-based mathematics and reform calculus curricula has largely focused on changes in achievement and attitudes, generally ignoring how students experience these new programs. This study was designed to address that deficit. As part of a larger effort to characterize students’ transitions into and out of reform programs, we analyzed how 93 high school and college students perceived Standards-based and reform calculus programs as different from traditional ones. Results show considerable diversity across and even within sites. Nearly all students reported differences, but high-impact differences, like Content, were not always related to curriculum type (reform or traditional). Students’ perceptions aligned moderately well with those of reform curriculum authors, e.g., concerning Typical Problems. These results show that students’ responses to reform programs can be quite diverse and only partially aligned with adults’ views.

Key words: College/university; Curriculum; High school (9–12); Integrated curriculum; Learners (characteristics of); Qualitative methods; Reform in mathematics education; Social factors

One inevitable outcome of the development of new curricula in any field, but perhaps particularly in mathematics, is to provoke discussion and debate about what content can and should be taught in schools and universities. The recent cycle of

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curriculum reform in mathematics, inspired by the 1989 *Curriculum and Evaluation Standards for School Mathematics* (NCTM), is no different. The publication and implementation of K–12 curricula developed in alignment with the *Standards* and of reform calculus curricula have provoked an intense debate about the “do’s” and “don’ts” of mathematics education (Addington & Roitman, 1996; Askey, 1997; Jackson, 1997a, 1997b; Reys, 2001; Wu, 1997). As some commentators have noted, this debate has largely undermined, rather than supported, collaboration and national progress toward improving the learning and teaching of mathematics for all students (Ralston, 2004; Schoenfeld, 2004).

Participants in the debate have at times buttressed their arguments about mathematics curriculum and/or pedagogy with appeals to students’ experience, in both reform and traditional programs. Too often, these appeals have taken the form of compelling single examples, presented as demonstrations of the bad (usually) or good outcomes that one program has produced. In the research community, the weakness of these arguments is clear: Colorful, engaging examples may be a staple of journalism (and also are powerful influences in generating anxiety among concerned parents), but they are at best counterexamples in logical argument. Students’ experiences are not all equivalent, and all of those experiences are of concern. Thus, single examples—particularly those chosen to make rhetorical points—are largely silent on the experiences of the larger population from which the example case was drawn.

The study reported here was designed to address this limitation. Our overall intent was to explore and document, in an even-handed way, how a reasonably large number of high school and college students judged *Standards*-based and reform calculus programs relative to more traditional programs. Our overall research question was: How do students perceive the differences between traditional and reform mathematics curricula and teaching? Addressing this question allowed us to turn to another: How do students’ sense of the differences compare to those of mathematics educators and the curriculum developers themselves? This study of students’ views of differences between reform and traditional curricula was part of a larger effort to conceptualize and understand students’ mathematical transitions as they move between programs in each tradition (Smith & Star, 2007).

Throughout this article we use the term “program” to denote the *enacted* curriculum—a written curriculum and the ensemble of instructional practices that engage those materials. As our results will show, the scope of our students’ perceptions of differences included references to aspects of the written curricula as well as aspects of classroom instruction. That duality was a natural outcome of our method, which sought to understand students’ view of their school mathematics in their own terms. We intentionally did not seek to exclude aspects of teaching practice (including issues of fidelity to the intended curriculum) from our inquiry because to do so would have been to draw an arbitrary line in the middle of students’ experience.
In general, the question of how students see differences between Standards-based and reform calculus programs in relation to more traditional ones has not been examined in any systematic manner. Much more attention, understandably, has been focused on the impact of new materials in terms of achievement and (to a lesser extent) attitude change, relative to traditional materials (Smith & Star, 2007).

A much smaller number of studies have focused more directly on students’ experiences—how they see and react to these new materials and teaching methods. For example, researchers at the Show-Me Center at the University of Missouri asked 1300 sixth- and seventh-grade students to write letters summarizing their “perceptions” of their 1st year in one of four Standards-based curricula, including the Connected Mathematics Project (Lappan, Fey, Friel, Fitzgerald, & Phillips, 1995). As excerpted by the research team (Bay, Beem, Reys, Papick, & Barnes, 1999; Reys et al., 1998; Reys, Reys, Lapan, & Holliday, 2003), these letters contained a mixture of attitude statements (e.g., liking or disliking some aspect of the reform program) and statements of how the reform program differed from the previous. The latter included reports that the content was new and/or more difficult, there were more problems set in realistic contexts and that required written explanations, and mathematics seemed more related to their everyday lives. Students expressed a range of attitudes about these differences, with some liking the new features and others preferring the corresponding traditional features. In addition, the authors reported that students’ attitudes differed widely from one classroom to the next, suggesting the influence of teachers’ attitudes toward or implementation of the new curricula (Bay et al., 1999).

As another example, Holt and colleagues (Holt et al., 2001) reported five students’ reactions to the Interactive Mathematics Project’s (IMP) (Fendel, Resek, Alper, & Fraser, 1996) high school reform curriculum, postgraduation. Since the students authored the report with their teacher, their analysis was even closer to what they experienced as students than the Bay et al. (1999) analysis. The students’ experiences with the IMP varied, but some common elements included a prior history of disliking and/or feeling unsuccessful in mathematics, an appreciation of the participatory and “democratic” aspects of IMP classrooms, and a sense that their teacher’s supportive stance toward IMP improved their experience.

1 Though the K–12 curriculum development inspired by the 1989 NCTM’s Curriculum and Evaluation Standards and the development of reform calculus programs have distinct histories, they evolved closely in time under the same set of historical conditions and share important common features. Both movements have promoted the centrality of conceptual understanding; increased use of “realistic” problems; technology for representation and computing; and the written expression of mathematical reasoning (Ganter, 2001; McCallum, 2000). In particular, the Harvard Calculus Consortium, the reform calculus curriculum examined in this study, also shares with the K–12 Standards extensive use of multiple representations, especially tables and graphs for the analysis of functions (Hughes-Hallett & Gleason, 1994). For these reasons, we feel justified in using the term “reform programs” to refer collectively to K–12 Standards-based programs and collegiate reform calculus programs.
Although these studies have provided glimpses of students’ experiences in Standards-based programs, we feel that much remains to be learned in this area. The studies described above did not systemically analyze all participants’ statements concerning their experiences with reform curricula but instead primarily reported salient themes and illustrative anecdotes. Such selective reporting of results may fail to capture the richness and diversity of students’ perceptions and experiences, including the inconsistencies that are likely among students in the same classrooms. Also, no prior study has specifically targeted students’ perceptions of differences as they move between traditional and reform curricula. We designed the present study in part to address these limitations.

METHOD

This study addressed three main questions. First, as students move between reform and traditional programs (and vice versa), what do they report as different? Second, how well do their views align with those of curriculum developers and researchers who have constructed their own comparisons (Star, Herbel-Eisenmann, & Smith, 2000; Trafton, Reys, & Wasman, 2001)? Third, of the differences that students report, which appear to have most substantive impact on their mathematical experience? Although students’ perceptions of difference may be interesting in and of themselves, analyses of student-reported differences will be more useful in national discussions of mathematics education if they clarify whether and how the differences mattered in students’ mathematical experiences. In our data analysis, we worked hard to distinguish differences that were simply noted from those that really mattered to the student.

Design: Sites, Curricula, and Participants

Given our intent to locate and analyze what students found different between traditional and Standards-based curricula, we needed sites where relatively abrupt shifts between such programs took place. We sought these curricular shifts at two major junctures in students’ mathematical histories: the steps from junior high to high school and from high school to college. At these two junctures, we sought schools and colleges with solid records of using reform materials. At the grades 6–12 level, our search was aided by numerous (though still very spotty) implementations of two Standards-based curricula written in our region—the Connected Mathematics Project materials (CMP) (Lappan et al., 1995) for grades 6–8 and the Core-Plus Mathematics Project materials (CPMP) (Hirsch, Coxford, Fey, & Schoen, 1996) for grades 9–12. We located a nearby district where CMP graduates moved into a traditional high school program (HS1) and another where high school students used the CPMP materials after a traditional junior high program (HS2). Two local universities provided complementary college sites. One (U1) used materials developed by the Harvard Calculus Consortium (HCC) (Connally, Hughes-Hallett, & Gleason, 1998; Hughes-Hallett & Gleason, 1994) for all
sections of Pre-Calculus, Calculus I, and Calculus II; the other (U2) a more traditional set of texts and teaching methods for these courses (e.g., Thomas & Finney, 1996). Pre-Calculus, Calculus I, and Calculus II were semester courses at both universities. At U1 we recruited graduates of traditional programs; at U2 we recruited from a smaller pool of CPMP graduates and also added graduates of a nearby high school that had developed its own mathematics program based on the NCTM’s Standards. Because we wanted to understand students’ mathematical experiences in some depth and over a relatively long period of time, we limited our research design to a single site per cell so that we could carefully examine a sizable sample of students at each site. These choices produced the site design matrix presented in Table 1.

Table 1  
Site Design: Four Sites by Educational Level and Type of Curricular Shift

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Type of curricular shift</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reform to traditional</td>
</tr>
<tr>
<td>Junior high to high school</td>
<td>HS1: From CMP into traditional</td>
</tr>
<tr>
<td></td>
<td>(n = 27; 15 male)</td>
</tr>
<tr>
<td>High school to college</td>
<td>U1: From CPMP into traditional</td>
</tr>
<tr>
<td></td>
<td>(n = 17; 8 male)</td>
</tr>
<tr>
<td></td>
<td>Traditional to reform</td>
</tr>
<tr>
<td></td>
<td>HS2: From traditional into CPMP</td>
</tr>
<tr>
<td></td>
<td>(n = 23; 9 male)</td>
</tr>
<tr>
<td></td>
<td>U2: From traditional into HCC</td>
</tr>
<tr>
<td></td>
<td>(n = 26; 10 male)</td>
</tr>
</tbody>
</table>

We recruited a total of 93 students across the four sites in the 1st semester of their freshman years (ninth grade or 1st year of college) and tracked their experience for 5 semesters, or as long as they took mathematics. Many college students only took 1 or 2 semesters of mathematics; the high school students generally took mathematics throughout the duration of the study. We also systematically observed instructional practice at all sites, including the two sites where reform curricula were currently being used (HS2 and U2), to assess their curricular implementations.

Data Collection

We assessed how students saw their current mathematics program as different from their previous program via a series of individual interviews and weekly journal entries. We also used our classroom observations as a check on how students were describing their current program. Students’ descriptions of classroom events generally matched our observations.

Interviews. We conducted, on average, two or three interviews per semester with each participant. Interviews were typically 20–30 minutes in duration at the high school sites and 45–60 minutes at the university sites. In the first interview, we asked
students to describe their prior mathematics program and their experience in it. At
the university sites, the first interview of the second semester involved a discus-
sion of the mathematics course just completed. At the high school sites, the final
interview of the year asked students about their sense of difference (new to old) on
such specific dimensions as the content, homework, types of problems, textbook,
group work, calculator use, and teaching. We sometimes asked direct questions
about what students saw as different (and usually received relevant responses), but
we also received responses about differences even when we did not ask. Overall,
we conducted 482 interviews with the 93 students, with an average of more than 5
per student.2

Journals. Students also wrote to us about their mathematical experiences, in and
out of class, when we were not present. On average, they wrote journal entries once
or twice a week, either by e-mail or in journal books. The requested focus on these
entries varied, from reporting on their experience doing homework, to studying for
assessments, to working in groups outside of class (at U2).

Class observations. To assess teachers’ enactment of their written curricula, we
observed current instruction in all our students’ mathematics classes. Observations
at the high schools were intensive during the 1st year of the project (which was the
students’ 1st year in their new program), at least twice weekly for each classroom
where our participants were placed. (We observed the classrooms of five teachers
at HS1 and six teachers at HS2.) Observations at the university sites were less
frequent because of the large number of sections involved; participants across all
project years were placed into 40 sections at U2 and 30 sections at U1. On average,
we observed in each student’s classroom twice each semester. The purpose of these
observations, and the resulting field notes, was to document the type and duration
of each instructional activity and the relation of the presented content to the written
curriculum. We also attended to the character of instructional practice in our students’
prior mathematics courses but in most cases retrospectively. In our interviews,
especially the first one, we asked students to describe their past teachers’ practices.
At the high school sites, we focused on the year immediately prior; at the university
sites, we asked students to describe each year of their high school program.

ANALYSIS

There were two main stages of data analysis: (1) coding difference statements,
and (2) determining the major differences and an overall difference judgment for
each student. Our results concern which differences had the most impact (overall
and at each site) as well as which students found their “new” mathematics program
as “substantially different” from their old.

2 There was substantial variation in how long students participated and therefore how many interviews
were conducted. University students, for example, typically only participated for a semester or 2
because their majors only required 1 or 2 semesters of mathematics.
Statement Coding

When we began our work, we knew of no prior study that reported a systematic listing of student-reported differences between Standards-based (or reform calculus) and traditional mathematics programs. Our first task, therefore, was to develop such a scheme “bottom-up” from the spoken and written data. We selected a representative subset of interview transcripts, read them as a group, identified dimensions of difference, and then progressively developed clear language to define these categories. We refined the definitions of each code until we could reliably code all student statements as (a) stating a difference (or not) and (b) an instance of a particular difference code. This process yielded the 26 differences listed and defined in Table 2.

Using this coding scheme, two coders read each transcript, independently coded each student utterance they felt included a statement of a difference, and then met and discussed their results. In the few cases where they disagreed after these resolution meetings, they consulted with a member of the research team for clarification. In addition, a member of the research team periodically spot-checked coded transcripts to monitor coders’ work and check for rater drift. In all cases, this process produced a single analysis of each transcript (a list of turns and difference codes). The journals contained relatively few difference statements and were coded by a member of the project team.

Determining an Overall Difference Judgment

Our research questions required steps beyond the coding of individual statements. We saw the mere one-time mention of a difference as far less important than reports of differences that expressed substantial impact. We wanted to distinguish, reliably and consistently, students who merely noticed differences from those for whom these differences substantially influenced their experiences in their new mathematics class. So we sought to divide our participants into two groups: Those who experienced their new program as substantially different from their old and those who did not. This “overall judgment” required a complex analytical framework, the development of which required many iterations. This procedure, described below, had two main steps. The first identified a subset of each student’s reported differences that were “Major”; the second used the proportion of Major differences to total differences to determine an overall judgment. The key idea was that if Major differences represented a considerable proportion of total differences, then the student saw the new program as substantially different.

Identifying “Major” differences. To qualify as Major, a difference must have been reported with at least two of the following three criteria: Frequency, magnitude, and detail. To qualify as frequently mentioned, a difference had to be mentioned in more than one third of a student’s interviews, with the exact proportion determined according to a sliding scale based on the number of interviews conducted. Magnitude required that the participant used emphasis words such as
<table>
<thead>
<tr>
<th>Difference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>Differences in the typical mathematics content addressed in the textbook(s), including global differences in the difficulty of the course material and whether or not it was “review” (Bay et al., 1999).</td>
</tr>
<tr>
<td>Textbook</td>
<td>Differences relating to the textbook (Reys et al., 1998), both in terms of its appearance and packaging and its “reader-friendliness.”</td>
</tr>
<tr>
<td>Typical problems</td>
<td>Differences in the type of problems that typically appeared in the textbook(s) or were assigned by the teacher, either in the body of the section or as homework problems (Bay et al., 1999).</td>
</tr>
<tr>
<td>Use of mathematical language</td>
<td>Differences in the mathematical vocabulary/language used in the textbook(s), such as the use of standard or conventional, nonstandard or informal, or invented terminology.</td>
</tr>
<tr>
<td>Use of nonverbal representations</td>
<td>Differences in the use of nonverbal representations of mathematical relationships (tables, graphs, equations, diagrams), including the presence/absence of representations, or a difference in which were emphasized.</td>
</tr>
<tr>
<td>Use of symbolic notation</td>
<td>Differences in the use of symbolic notation, including the amount of symbolic manipulation presented in the textbook(s).</td>
</tr>
<tr>
<td>Class size</td>
<td>Differences in the number of students in class.</td>
</tr>
<tr>
<td>Duration</td>
<td>Differences relating to the duration or time of the class.</td>
</tr>
<tr>
<td>Pace</td>
<td>Differences in how quickly the student felt that the teacher moved through the content in the class, either because of a mathematics department policy about how much of the curriculum must be covered or because of the teacher’s own choices.</td>
</tr>
<tr>
<td>Assessment</td>
<td>Assessment refers to all student work that contributed directly to their grade. Differences include both changes in the assessments given (e.g., length, kinds of problems, frequency) and how they were scored.</td>
</tr>
<tr>
<td>Basic communication</td>
<td>Differences in how students understood what their teacher said in class, that is, their literal comprehension: e.g., whether they could hear, understand, or follow the teacher’s speech.</td>
</tr>
<tr>
<td>Classroom management</td>
<td>Differences in how the teacher organized and managed work in the classroom independent of the lesson.</td>
</tr>
<tr>
<td>Difference</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Group work</td>
<td>Differences in how the work in small groups was organized, in the classroom, including frequency of use, size of groups, and selection of groups.</td>
</tr>
<tr>
<td>Homework</td>
<td>Differences relating to course homework.</td>
</tr>
<tr>
<td>Lesson format</td>
<td>Differences in either the kind of activities that made up typical lessons or the sequence or time allotted to them.</td>
</tr>
<tr>
<td>Opportunities for participation</td>
<td>Differences in the opportunities that teachers provided for students to participate in mathematical activity in class.</td>
</tr>
<tr>
<td>Teacher's fidelity to the textbook</td>
<td>Differences in how closely the teacher “followed” the book—that is, presented the content to the class as it is presented in the textbook.</td>
</tr>
<tr>
<td>Teacher-student relationship</td>
<td>Differences in the student’s feelings toward their teacher or their perceptions of their teacher’s feelings toward them, including issues of accessibility, trustworthiness, care for students, ease of contact outside of class.</td>
</tr>
<tr>
<td>Teaching style</td>
<td>Differences in how the teacher taught that were not captured in other categories.</td>
</tr>
<tr>
<td>Use of calculators</td>
<td>Differences in if and/or how calculators were used in the classroom.</td>
</tr>
<tr>
<td>Use of examples</td>
<td>Differences in the use and role of examples, such as the repetitiveness and frequency of the examples.</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Differences in the student’s sense of their role or responsibility in learning.</td>
</tr>
<tr>
<td>Coherence or connections</td>
<td>Differences in how coherent or connected the topics, chapters, or units in the textbook(s) seemed to the student, i.e. how well the various topics, chapters, or units fit together or built on each other.</td>
</tr>
<tr>
<td>Relevance of mathematics</td>
<td>Differences in the relevance of topics and problems in the textbook(s) to the student’s life, current or future, in or out of school (Bay et al., 1999).</td>
</tr>
<tr>
<td>Level of understanding</td>
<td>Differences in the character of the student’s mathematical understanding.</td>
</tr>
<tr>
<td>Other</td>
<td>Any difference between some aspect of the “new” relative to “old” program that did not fit any category listed above.</td>
</tr>
</tbody>
</table>
“a lot,” “very,” “much more,” “definitely,” and/or “big” to amplify his or her description of a difference. Detail required substantial descriptive richness in the students’ report of a difference. We felt that the presence of at least two of these three criteria indicated that a difference “made a difference” in a student’s experience. Therefore, we labeled such differences as “Major.”

**Proportion of “Major” differences to all mentioned differences.** We then determined the proportion of each student’s difference statements that met our Major criteria. In general, if about one third of a student’s reported differences were Major, we concluded that he or she found the new mathematics program substantially different. We consciously selected the 1:3 ratio (Major differences to total differences) as a relatively high threshold for “substantially different,” in part because we asked students more directly about differences than other aspects of their mathematical experience.

When these participant-level analyses were complete, we aggregated results by site to see which differences had the greatest impact overall.

**RESULTS**

We begin by addressing the issue of instructional fidelity to traditional and reform teaching practices at each site. Second, for completeness and to appreciate the fundamental diversity of participants’ responses, we compare the frequency of all 26 differences reported across sites. We then present a detailed examination of (and contrast between) the results at each site, as the site-specific dimension of our results is, to us, quite striking.

**Instructional Fidelity**

We found some within-site variation between teachers’ practice at both high school sites. The daily practice of one of the five teachers at HS1, the traditional high school, included reform elements (graphing calculators and small-group work) in her generally traditional practice of presenting solution procedures. Similarly, one of the six teachers at HS2, the reform high school, included one traditional element (worksheet practice on some problem types) in his use of the CPMP curriculum. However, the instances of teachers at either site supplementing or deleting content from the written curricula were rare; teachers generally taught the written curriculum, though they used slightly different techniques. Results at the university sites, particularly U2, were more complex, in part because so many instructors were involved. The dominant instructional activities at U1 were lecture presentation, even in the small sections of Calculus I, and instructor presentation of solutions to homework problems, especially in section meetings. Student vocal participation in lecture presentation was minimal, even in small sections. At U2, we found considerable variation in the classroom practices of instructors, most of whom were graduate students who were new to teaching. For example, they varied in their ability to organize effective small-
group work. However, their lessons were structured by department mandate to include small-group problem solving and student presentation of solutions and to limit the extent of instructor presentation (Star & Smith, 2006).

**Overview by Difference**

Our first result with respect to what students noticed as different can be stated rather simply: Across sites, we found substantial diversity in the differences that students perceived between Standards-based and reform calculus programs and traditional mathematics programs. Table 3 lists the percentage of students by site who mentioned each of the 26 differences in any interview and the percentage for whom each difference was Major—in the order of their overall impact (as measured by percent Major in the entire sample).

The reporting of differences varied substantially across the sites. With the exception of **Content** and **Typical Problems**, none of the other 24 differences were even mentioned by 75% of the students at all sites. Perhaps more important, none of these 24 were Major differences for more than 25% of the students at all sites. The results at HS2 contributed substantially to this variance: Only **Content** and **Typical Problems** were important differences at this site. (Here and below, our somewhat arbitrary threshold for an “important” difference is that at least 50% of the students mentioned the difference and at least 25% found it Major.) By contrast, students at HS1 reported the largest number of differences (7) that were both mentioned by at least 50% and Major for at least 25% of participants. The university sites fell in-between these two high school extremes.

For example, consider **Assessment**. Across all sites, 12% of students found **Assessment** to be a Major difference. But this mean value obscures quite different results at the four sites. For no participant at HS2 was **Assessment** Major, as compared to 6% at U1, 15% at HS1, and 31% at U2. Similarly, for **Teacher-Student Relationship**, for no participant at HS2 was this difference Major, as compared to 18% at U1, 30% at HS1, and 38% at U2. Clearly, the felt impact of changes in assessment and in teacher-student relationships was quite site-specific. We took this top-level variation across sites as the warrant for looking carefully within each site, as described and reported below.

Ten differences were not important issues for students at any site: **Autonomy**, **Coherence and Connections**, **Class Duration**, **Use of Mathematical Language**, **Basic Communication**, **Class Size**, **Use of Nonverbal Representations**, **Use of Symbol Notation or Manipulation**, **Level of Understanding**, and **Teacher’s Fidelity to the Textbook**. None of these differences was mentioned by 50% (or more) or was Major for 25% (or more) of the students at any site. In addition, **Other**, the residual category, included numerous particular and idiosyncratic differences, but in only two cases (both U2 students) did these qualify as Major.

**Site-by-Site Results**

We now present a more detailed view of the results at each site than Table 3
<table>
<thead>
<tr>
<th>Difference</th>
<th>Site</th>
<th>HS1 ((n = 27))</th>
<th>HS2 ((n = 23))</th>
<th>U1 ((n = 17))</th>
<th>U2 ((n = 26))</th>
<th>Total ((n = 93))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Mention</td>
<td>% Major</td>
<td>% Mention</td>
<td>% Major</td>
<td>% Mention</td>
<td>% Major</td>
</tr>
<tr>
<td>Content</td>
<td>96</td>
<td>74</td>
<td>87</td>
<td>35</td>
<td>88</td>
<td>41</td>
</tr>
<tr>
<td>Typical problems</td>
<td>96</td>
<td>48</td>
<td>74</td>
<td>57</td>
<td>53</td>
<td>12</td>
</tr>
<tr>
<td>Homework</td>
<td>93</td>
<td>44</td>
<td>48</td>
<td>0</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>Teacher-student relationship</td>
<td>63</td>
<td>30</td>
<td>26</td>
<td>0</td>
<td>53</td>
<td>18</td>
</tr>
<tr>
<td>Textbook</td>
<td>89</td>
<td>41</td>
<td>65</td>
<td>13</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Lesson format</td>
<td>93</td>
<td>33</td>
<td>17</td>
<td>4</td>
<td>59</td>
<td>12</td>
</tr>
<tr>
<td>Group work</td>
<td>85</td>
<td>41</td>
<td>35</td>
<td>0</td>
<td>59</td>
<td>18</td>
</tr>
<tr>
<td>Assessment</td>
<td>59</td>
<td>15</td>
<td>30</td>
<td>0</td>
<td>47</td>
<td>6</td>
</tr>
<tr>
<td>Pace</td>
<td>48</td>
<td>11</td>
<td>43</td>
<td>4</td>
<td>76</td>
<td>35</td>
</tr>
<tr>
<td>Use of calculators</td>
<td>78</td>
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provides. We begin with HS2 because the results at this site were relatively simple and straightforward.

**HS2: From traditional into reform.** Students at HS2 left a traditional junior high school program and entered courses using CPMP materials. Only 3 of 23 students at HS2 found their high school mathematics experience substantially different from their junior high school experience. This was the smallest overall impact among the four sites. Two differences, *Content* and *Typical Problems*, dominated students’ comparisons of these two programs. The three students (all females) who saw the new program as substantially different from the old found both *Content* and *Typical Problems* to be Major differences. Six other differences—*Textbook, Teaching Style, Use of Calculators, Relevance of Mathematics, Pace, and Homework*—were mentioned by at most 40% of the students but were Major for few.

*Typical Problems* was reported relatively consistently at HS2 (74% of the students) and was a Major difference for more than half (57%). The students saw CPMP problems as more likely to be “story problems” that were less repetitious than junior high school problem sets, involved more thinking, and required more writing to explain final answers. For example, SD³ saw CPMP problems as starkly different from Pre-Algebra problems:

> [W]e never did, like, story problems in eighth grade [Pre-Algebra] and now learning the story problems, you have to figure out what you’re doing with them, you have to figure out how it goes. . . . Cause it was all story problems, all story problems that we ever worked with. (HS2, female, YES)⁴

Similarly, DC emphasized the difference in terms of decreased repetition and a radically improved attitude toward the subject, even as she worried that college and the “real world” were more aligned with “traditional” math. DC’s view of reform curricula runs quite contrary to the intentions of the authors of those curricula: She felt that the real world of mathematics was not given in story problems but in more traditionally structured problems:

> I thought it was really different because you kind of worked on the same things [in CPMP], but in a different manner. Lots of story problems and lots of group work and lots of things that made sense, but I questioned how it would help me prepare for the real world. . . . [CPMP is] a lot better, but I’m kind of scared that it’s not helping me for college. (HS2, female, YES)

Students at HS2 were also relatively consistent in how they saw the *Content* difference. Of the 20 students who mentioned this difference, 10 mentioned new topics in CPMP and 8 found the program more difficult than junior high mathematics. When asked what she would tell rising ninth graders to prepare them, HLL emphasized difficulty: “I would tell them it is a lot different, in that you are going to be challenged more, but it would also help you more” (HS2, female, YES).

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³ All participants are identified with two- or three-letter pseudonyms.

⁴ As part of the citation for each student quote, we provide the student’s pseudonym, sex, and the overall difference judgment.
Overall, these results suggest a consistent view of traditional-reform differences among students at the HS2 site. With some exceptions, these students found the CPMP program contained more varied and challenging content than junior high school and emphasized problems set in realistic contexts that required more thinking and writing. Generally speaking, this description matches well the CPMP developers’ characterization of defining features of their curriculum (Schoen & Hirsch, 2003).

**HS1: From reform into traditional.** The HS1 results were considerably more complex. Recall that HS1 students moved from CMP in middle school to a high school that used more traditional materials. In stark contrast to HS2, where only 3 of 23 (13%) students earned an overall difference judgment of YES, 16 of 27 HS1 students (59%) earned a YES overall judgment. Six differences had the greatest impact: Content, Typical Problems, Homework, Textbook, Group Work, and Lesson Format. All six were mentioned by at least 85% of HS1 students and were Major for at least 33%. One more difference, Teacher-Student Relationship, was also important, but at a slightly lower level of impact. More generally, HS1 was the site with the highest frequency of differences mentioned and qualifying as Major.

Ninety-six percent of HS1 students mentioned Content as a difference, and 74% found it to be Major. Their views of the Content difference generally paralleled the students at HS2. For some HS1 students, the Content difference represented recognition that their high school course dealt with a different domain of mathematics (e.g., geometry as opposed to algebra) or introduced material that was new and unfamiliar. Some of these students, like ZZ, even expected this change: “The math is just a lot more complex, which you expect as we get older. So it’s going to be different” (HS1, male, YES).

As at HS2, Typical Problems was also widely reported: Almost all HS1 students (96%) mentioned this difference, and 48% found it to be Major. Their characterization of this difference also matched the reports of HS2 students: eighth-grade CMP problems were more likely to be “story” or application problems than ninth-grade traditional problems. Every student who found Typical Problems to be a Major difference commented on the greater frequency of story problems in their previous math class.

HS1 participants also reported several other issues related to Typical Problems. Some students, such as GA (HS1, male, NO), noted a lot more variety in the problems in eighth grade, which included both equations and graphs. For GA, ninth-grade Algebra I mathematics problems seemed to focus more exclusively on equations. TD (HS1, male, YES) made a similar observation, comparing the greater variety of story problems in eighth-grade CMP to the more repetitious “problem problems” in ninth-grade Geometry.

However, in contrast to the claims of some reformers (but consistent with a recent study by Koedinger and Nathan, 2004), most HS1 students felt that the more traditional ninth-grade problems required more thinking than the previous CMP problems. For example, CT felt that ninth-grade problems were more demanding than those from eighth grade:
The stuff that we are doing this year [ninth grade] is a little more challenging than last year. Like the problems are a little tougher that what they were last year. [What would you say makes them tougher?] They’re adding more variables and expecting to do a little more than what we had to do in middle school. (HS1, male, NO)

Similarly, HJJ noted that in ninth grade, “It just seems like you have to go through more now to come out with your final answer. You have to go through more steps and stuff like that” (HS1, male, YES).

*Homework* was mentioned by 93% of HS1 students and was found to be Major by 44%. Students noted that high school homework was usually assigned every day, which was not typically the case in eighth grade. As FKM indicated, “Last year [in eighth grade], we didn’t have homework everyday. Like I take this [ninth-grade homework] home with me everyday” (HS1, male, YES). In addition, most HS1 students who mentioned homework commented on an increase in the number of problems in a typical assignment. AK expressed a common sentiment: “Like last year [eighth grade] we probably only did like 10 or 15 [problems] a night. . . . This year it’s like 1 through 36, and then 48 through 50, or whatever” (HS1, female, YES).

*Textbook* was another curricular difference that HS1 students mentioned frequently (89%) and often found to be Major (41%). As with *Content*, this is not a surprising result, given that the physical characteristics of the eighth-grade CMP textbooks (a series of short colorful softcover books) were so clearly different from the bulky hardcover traditional textbooks used in ninth-grade Algebra and Geometry. For many students, this difference was measured in terms of convenience, as KB noted, “Textbooks in eighth grade were great because they were like split up into sections and they were small and so you didn’t have to carry around this big 5 or 10 pound book around. It was just nice” (HS1, female, YES).

But most of those who found *Textbook* to be a Major difference commented both on the appearance of the books and their comprehensibility. The consensus on the latter point was that the eighth-grade CMP textbooks “went into a little more depth in explaining than they do” (CT, HS1, male, NO).

*Group Work* was mentioned by 85% of HS1 students and was Major for 41%. Students’ reports primarily concerned a change in its frequency between eighth and ninth grade. However, and somewhat surprisingly, they were evenly divided as to whether group work became more or less frequent in high school. BJB felt that group work was much more frequent in his eighth-grade classroom: “We normally did everything as a class or in groups [in eighth grade]. [And this year you’re not?] Yeah, we don’t do nothing in groups” (HS1, male, NO). However, LLS’s experience was completely different. She noted, “We did more individual work last year [in eighth grade]. . . . It really was, it seems, more individual, because now [in ninth grade] everything we do, we do in groups, I swear. Like I’m always working with [a classmate]” (HS1, female, YES). One way to interpret this apparent contradiction is that both eighth- and ninth-grade teachers at HS1 exhibited considerable variation in their use of group work—a fact that we directly documented in our observations at the high school.
Overall, HS1 students’ comparisons were among the most extensive in our sample; they mentioned many differences and found many of those to be Major. However, what these students reported as different was partially related to the curricular shift (from CMP to traditional materials), partially related to general differences between middle school and high school (new and more difficult high school content), and partially related to teacher-specific effects (the differential use of group work). And in the case of differences in homework, students’ observation that homework in traditional high school programs had more problems and was more frequently assigned appeared to be related to all three of these factors. HS1 students did notice a decrease in story problems as they moved to ninth grade, but the impact of this change appeared to be overshadowed by more general differences in the content and in the resulting increase in the complexity and depth of typical problems.

U1: From reform into traditional. Recall that U1 was the site with the smallest number of participants \( (n=17) \). U1 participants had had two sorts of reform experiences: a total of 12 used the CPMP materials in high school, and 5 others graduated from one local high school that had developed its own mathematics curricula and pedagogy aligned with the NCTM’s Standards. Six of these 17 students (35%) found their university mathematics experience substantially different from their high school experience, so U1 was the second lowest overall impact site after HS2. Five differences, Content, Pace, Teaching Style, Group Work, and Teacher-Student Relationship, had the greatest impact, both among the six who found their new program substantially different and in the whole U1 sample. Of these five, Pace and Teaching Style had a major impact only at U1. By contrast, Typical Problems, important at every site, had its weakest impact at U1. Other differences that proved important elsewhere (Lesson Format, Assessment, Textbook, and Homework) had a more limited impact at U1.

Content was mentioned by all but two students at U1 and was a Major difference for seven. Moreover, every student who found his or her traditional college mathematics program substantially different reported Content as a Major difference. U1 students described content differences in terms similar to other sites: College content was often new and more difficult, and involved exploring topics in more depth or detail. DJM, who entered Calculus I from AP Statistics in 12th grade after completing the 3-year CPMP course sequence at his high school\(^5\) had perhaps the strongest reaction:

> It is all kind of like a foreign language to me right now. Each chapter I get to it is like a foreign language and I regret not preparing myself better. If I had to do it all over again, I would take Calculus [in high school]. (U1, male, YES)

When asked about differences in content, HK, another CPMP graduate, emphasized the shift in how content was presented: “That is a lot different also, in Calc we have

\(^5\) When our university students were in high school (in the late 1990s), only the 3-year CPMP course sequence was available.
a lot of theorems and definitions and what not and in Core it was just a bunch of story problems” (U1, female, YES).

The second most important difference at U1, *Pace*, was more straightforward: Instruction moved faster in college than high school. For all but one of the students who found college mathematics substantially different from high school, *Pace* was a Major difference; the faster pace of college classes posed a challenge to their learning. For DJM (U1, male, YES) the pace in Calculus I was quick, even after taking into account that college courses generally moved faster. DLM found that the pace of instruction fundamentally changed what she needed to do to succeed in Calculus II:

I mean in my class right now it is really quick paced. . . . In my high school classes I could totally understand everything before we moved on. And now I have to kind of like go back and like review and try to understand things. (U1, female, YES)

Similarly, WN (U1, male, NO) explained that the quick pace in college limited his professor’s elaboration of core ideas, making it harder for him to make sense of each topic.

In contrast to other sites, especially HS1, U1 students reported a clear difference in *Group Work*: They felt it was less frequent in their college classes. Ten of the 17 students mentioned this difference; 5 found it a Major difference. BLJ (U1, female, NO) observed that the decrease in group work in college was coupled with an increase in lecture presentation. Most of the students appeared to miss the group interactions, as HK illustrates: “The biggest difference is that in Core it was mainly group work and here there is really no interaction between the students” (U1, female, YES). Group problem solving was also integral to MJ’s learning process: “We would, in contrast [to college], learn as we did problems, and maybe step-by-step go through it and we’d do it in our group. And it was a lot less lecture type material in high school” (U1, male, NO). Indeed he had found the group work so useful he had met with peers outside of class to solve problems before his high school tests.

Finally, two differences with the most impact on U1 students concerned differences in teaching, *Teacher-Student Relationship* and *Teaching Style*. Over half of U1 students (9 of 17) mentioned a more distant relationship with their college teachers. They found their professors less accessible and less personal than their high school teachers. *Teaching Style* was a residual category; it collected differences in teaching not captured by other teaching differences (see Table 3). Ten students mentioned this difference; for 5 students it was a Major difference. Most who mentioned *Teaching Style* made some reference to presentation methods in U1 classrooms. BP (U1, male, NO) described college presentation as “direct,” which also communicated a “noncaring” attitude to him. HLJ (U1, male, YES) found the content “given to you,” which involved “less thought process.” MJ (U1, male, NO) noticed how often his professor had his back to the class, a marked difference from high school. These examples suggest that *Teacher-Student Relationship* was distinct from *Teaching Style* only in our coding process. For U1 students, how professors
presented mathematics influenced the kind of relationship they could develop with their new teachers.

Results at U1 showed a strong impact of educational level and a considerably weaker impact of curricular shift. Of the five differences that had the strongest impact on U1 students, at least three (Pace, Teaching Style, and Teacher-Student Relationship) characterize the challenge of college classrooms, in contrast to high school. Only in the examples of Content and Group Work illustrated above was the effect of the shift into traditional mathematics content and instructional processes clearly evident.

U2: From traditional to HCC. At U2, 19 of 26 students (73%) found college mathematics using HCC to be substantially different from the traditional curriculum used in high school. Five differences stood out as having the greatest impact: Typical Problems, Homework, Content, Teacher-Student Relationship, and Assessment.

As at HS2, the other site where students moved from a traditional to a reform curriculum, the most common difference for U2 students was the dramatic increase in the number of story problems in the HCC program (Typical Problems). Of U2 students, 96% mentioned this difference; 69% found it Major. Although students did report completing some story problems in high school, they appeared much more frequently in HCC. U2 students reported that HCC word problems were not only more prevalent, but they were also harder and had more parts. CLM expressed this perspective: “The problems [in college] are kind of worded different then they would be in high school. Now, it’s like almost every problem is a story problem and it has a lot of steps” (U2, female, YES). Similarly, NM couched the difference in terms of problem complexity: “Like the [high school] textbooks had a few story problems but not it wasn’t as like in depth as these [college problems] are, I think. Like the story problems that I remember from textbooks in high school were pretty simple” (U2, female, NO).

In another parallel to HS2, U2 students’ perceptions that the frequency of story problems had increased was also accompanied by different expectations for how story problems should be solved. U2 students were required to explain their solution steps in clear written English. GJS described what she was required to do in college mathematics classes: “She just wants us to write out paragraphs, she’s correcting grammar, which I think is ridiculous in a math class. . . . We’ve had to like write paragraphs for our group homework or page long things that explain stuff that was obvious” (U2, female, YES). BE put the difference very similarly but did not object to the new expectations as GJS did: “In the college calculus . . . you have to explain our answers in words a lot. . . . I’m not used to doing it, because I never really had to, so it’s kind of something new” (U2, male, YES).

Although several U2 students agreed with BE, most felt that providing explanations was tedious, unnecessary, and very different from what was expected of them in high school. JLC described a very commonly expressed sentiment about explanations: “I think it’s kind of redundant, ’cause I don’t think if we know how to do it we don’t need to say that we know every single step. . . . But yeah I guess it was a pretty big difference” (U2, male, NO).
The combination of more story problems and the expectation to provide written explanations to accompany problem-solving steps (differences related to *Typical Problems*) were tightly connected, in students’ minds, to differences in *Content*. U2 students commented that college mathematics was new, more complex, and harder to do. Whereas high school problems typically involved practicing a series of procedures that had to be memorized, HCC word problems required more understanding of the mathematics. As JJC noted, “My whole thinking is if you get the right answer especially on like story type problems that you have to know the concept behind it or you’d never be able to start like figuring out the problem” (U2, male, NO). Similarly, BD noted that, although he had covered many of the same calculus topics in his high school AP Calculus class, his college mathematics courses had much more of a conceptual emphasis: “Yeah I think that the focus on the conceptual level is really the biggest difference because the course curriculum beginning to end was pretty much all in AP Calc” (U2, male, YES).

Students’ comments about *Typical Problems* and *Content* were also intricately connected to their observations about differences in *Homework*. A frequently noticed feature of the HCC implementation at U2 was the use of group homework assignments. Students were assigned a weekly problem set that had to be completed outside of class in assigned groups of four. According to students, group homework was typically composed of very challenging story problems. In addition to figuring out the correct solution, students were also expected to provide detailed written explanations to accompany their work. Many U2 students expressed negative opinions of group homework, mainly because of dissatisfaction with some group members’ contributions to the team (e.g., lack of preparation or absence from group meetings) or logistical problems (e.g., difficulties in finding times that all group members could meet). As SB noted in her journal,

> My team homework group is the exact antithesis of a team. ‘There is no I in team’, well in this team there are about four. We met yesterday and worked on the problems for about an hour then finally decided that it would be a lot easier to just split them up. (U2, female, YES)

However, other students came to value the group assignments, because the group provided resources for learning that were not available while working alone.

Students’ perceptions at U2 formed a very coherent picture of their reaction to HCC in contrast to high school. Students noticed an increase in story problems and a related focus on providing written explanations for each step in their solutions of those problems, an increase in out-of-class group homework, and more demanding assessment problems and scoring, all occurring in more challenging mathematics classes in the more impersonal environment of college. Four of the five differences that had the strongest impact (all but *Teacher-Student Relationship*) were closely tied to characteristic features of HCC or to its particular implementation at U2. In short, the effect of the curricular shift was strong at U2.
DISCUSSION

In our broader investigation of students’ experiences moving between traditional and reform mathematics programs, we were particularly interested in what students noticed as different between programs and whether the differences that students reported indicated their experience of school mathematics had been substantially changed. We were also interested in evaluating how students’ perceptions of differences did or did not match those of curriculum developers and researchers in mathematics education who have produced and examined Standards-based and reform calculus materials.

Main Findings

Relative to these issues, our data support the following five general results. First, students did notice differences as they moved between traditional and reform mathematics programs. Only one student (from HS2) out of our sample of 93 reported no differences between his current and prior mathematics programs. In fact, 90 of the 93 mentioned four or more of our 26 possible differences, and more than one fourth of our sample (26 students) mentioned at least half of all the differences in our scheme. Clearly, students saw differences between traditional and reform mathematics programs.

Second, the differences that students reported did appear to have a substantive impact on their mathematical experiences: Forty-four of 93 students (47%) earned a YES on our overall difference judgment. Recall that the overall difference judgment distinguished between those students who merely mentioned differences and those for whom these differences substantially mattered, and that we intentionally set a high threshold for achieving a YES judgment. Yet almost half of our sample met the YES criterion, indicating that the differences they reported made a difference in their perception of their mathematical experience.

Third, what students reported and found to be substantially different varied widely, site by site. In general, we did not find evidence of a common experience among all, or even most students (beyond the effects of Content and Typical Problems). Students’ experiences at one site were more different from those at another site than alike. In addition, considerable intersite differences also existed, especially at HS1. These results suggest that it is quite problematic to refer to differences that “students” (in a generic sense) see between Standards-based and reform calculus programs and more traditional ones. It was only at the site level—and only in three out of four sites—that we found reasonable convergence and coherence among students’ experiences.

Fourth, students’ sense of difference aligned moderately well but not perfectly with the views of curriculum developers and researchers. Students found several differences not directly related to the principal design features of the reform to be salient and meaningful, including changes in teacher-student relationships in college and the increased difficulty of unfamiliar content in “new” mathematics courses. These differences dominated students’ experiences, particularly at the college sites, and in essence overshadowed many curriculum-related differences.
Although reformers have not explicitly denied or discounted the effect of these issues on students, they have tended to emphasize other features of their curricula and associated teaching practices. Perhaps more important in this respect, students also failed to find noteworthy (or had somewhat conflicting impressions of) some aspects of reform curricula that have featured prominently in researchers and curriculum developers’ descriptions, such as the relevance of mathematics, opportunities for participation, and group work. The results of this study are therefore a useful reminder that aspects of new mathematics programs that are salient to concerned adults may or may not be salient to students involved in those programs.

On the other hand, and fifth, some major design features of reform curricula were among the differences that had a strong impact on students across sites. Students at all sites reported the increased frequency in contextualized “story” problems in reform programs and often also reported other features associated with this change in typical problems—different kinds of thinking required, different sorts of “solutions” expected, and different sorts of assignments of problems, e.g., number of “story” problems. Students noticed this difference, and it had a substantive impact on their mathematical experience.

In closing, we reiterate that our focus was specifically on students’ view of differences, not on the impact of program change, either into or out of reform. We have argued for a broader conception of impact elsewhere (Smith & Star, 2007), but the present analysis more narrowly concerned what students see as different. Notably and purposefully absent from this analysis were several other variables that certainly would paint a more complete picture of students’ experiences: Students’ affective responses to the different programs (e.g., their likes and dislikes) and whether and how students vary their learning activities in response to program shifts. But in the present study, we attempted to determine which differences mattered to students independent of their affective reactions. Although we recognize (and as many of the prior quotes from students show) that it is difficult to ignore affect in determining which differences were important to particular students, our careful analytical scheme for determining Major differences was designed to do exactly that.

To the extent that we did take note of affect in our analysis of differences, our careful reading and analysis did not show any clear pattern of preference for one program of curriculum and teaching over the other. Some of our students’ reactions to differences can be interpreted as also expressing (positive) preferences for certain features of reform curricula and/or pedagogy, but the reactions of others can equally be interpreted as preferences for features of traditional curricula. In fact, many students’ reactions were quite mixed, expressing both positive feelings for one curriculum in one difference and negative reactions to that same curriculum in another difference. We chose to identify which differences substantially influenced students’ experiences, where our notion of “influence” included both positive and negative effects, in part to honor this complexity.

The principal finding that students’ view of differences varied substantially between sites makes it difficult to separate out and estimate—as mathematics
educators might want to do—particular effects of curriculum, pedagogy, assessment, and site-specific organizational decisions. Furthermore, given that our research design purposefully did not include “control” groups (e.g., traditional to traditional or reform to reform sites), it was not possible (nor was it our goal) to isolate the effects of a curricular shift above and beyond the differences that might be expected as students change teachers, classrooms, and schools. Different research designs may permit exploration of these kinds of questions, and we hope the methods and results of our exploratory study spur additional work in this area.

Finally, the site-specific nature of these results also makes it difficult to know what patterns might emerge from a wider sampling of high schools and universities—if sites with relatively abrupt shifts into or out of reform could be found. Even if one were to locate and study such sites, there are potential problems in attempting to build on and test the validity of our results by diversifying the empirical base. In this study, individual teacher’s beliefs and practices seem to have created different pockets of experience within educational sites—an effect reported by others (Bay et al., 1999; Holt et al., 2001; Reys et al., 1998). So if teachers’ differential acceptance and presentation of reform underlies strong site-specific effects in students’ views of reform and traditional mathematics programs (curricula and teaching practices), the character of students’ experience could easily be obscured in analyses that aggregate across sites. The effects of aggregation were present in this study (despite our efforts to counteract them in our analyses and report), but such effects would be much greater in a larger-scale study that involved more sites, many more students, and more teachers. Indeed, the average effect could be quite misleading and unrepresentative.

Implications

For teachers, researchers, and curriculum developers interested in the “impact” of current reforms, these results are a reminder that diversity in students’ views of what is interesting, appropriate, challenging, helpful, and worthy in school mathematics are not unitary; they vary considerably. For teachers, this suggests that occasional open and frank classroom discussions of the features of programs of mathematics, new and old, may be productive—because in them, students could hear and consider their peers’ perspectives. Although such discussions might seem threatening to teachers or a waste of precious instructional time, they could also raise questions for and enlighten students about important issues related to their learning of mathematics that are seldom discussed. For researchers, the assumption of diversity in students’ reactions to reform should support better research designs and more careful analyses in future studies. Simple schemes for exploring and analyzing students’ reactions will not be useful and may produce misleading results. For curriculum developers and others pondering these central questions in mathematics education—what should we teach, when, and why?—the principal message of this study is that substantial changes in how we address those issues in classrooms will likely be noticed by students. However, the aspects of new mathematics
programs that are salient to concerned adults may or may not be salient to students involved in those programs.

REFERENCES


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