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The Effects of Homogeneous Groupings in Mathematics. ERIC/CSMEE Digest.

The practice of homogeneous grouping, which is quite widespread in the United States, uses a model that typically groups students together on ability or achievement as the deciding variable. At the high school level, this practice is most prevalent in mathematics, where students are placed in vocational, general, or college-preparatory mathematics courses (McPartland, Coldiron, & Braddock, 1987; Oakes, 1985, 1990a, 1990b; Slavin, 1990). It also occurs at the middle or junior high school level in those schools that offer algebra at the eighth grade (McPartland, Coldiron, & Braddock, 1987; Oakes, 1985, 1990a, 1990b; Slavin, 1990). According to the Second International Math Study (SIMS), ability grouping is more extensive in the United States than any other country studied (Oakes, 1990a). Students at the elementary school level may also be tracked or grouped, although at this level students are more often grouped by general measures of ability or achievement rather than ability or achievement in mathematics (Oakes, 1985, 1990a, 1990b; Slavin 1987a, 1987b).

A second instance in which students are often homogeneously grouped is the small groups in classrooms where clusters are based on ability or achievement within that particular classroom. This has been an established practice for reading instruction at the elementary school level for years. Teachers frequently will organize their classrooms in a similar format for mathematics instruction (Oakes, 1990a; Slavin, 1987a, 1987b). The practice of placing small groups of students into high, medium, or low groups for mathematics instruction is less common at the middle, junior, or high school level where students tend to do less work in small groups and are sorted by the particular course (Slavin, 1990).

Such practices seem to stem from the widespread belief children's intellectual differences are so great that students with different ability or achievement levels need to be taught in separate classes or groups (Oakes, 1990a, 1990b). However, a number of concerns have been raised about the long-term effects of these grouping practices.

EFFECTS ON OPPORTUNITY TO LEARN MATHEMATICS

In a National Science Foundation study of the way in which this nation's educational system provides opportunities to learn mathematics and sciences, cross-sectional data about mathematics and science programs, teachers, and classroom practices at the elementary and secondary school level were analyzed (Oakes, 1990a). These data were from the National Science Foundation's 1986 National Survey of Science and Mathematics Education (NSSME). While an analysis of these data showed important differences in opportunities to learn mathematics between schools, important differences were also found within schools. This seemed to be related to the practice of placing students into different tracks based on ability, achievement, or career expectations. The report identified three areas in which inequities in mathematics instruction were found: (1) access to strong mathematics programs; (2) access to well-qualified mathematics teachers; and (3) access to classroom opportunities.
In most of the high schools described in the study, fewer mathematics courses were

available or required for low-track students. Standard and advanced college-preparatory courses were offered to students perceived as having high ability, less often to students thought of as having average ability, and rarely to students seen as having low ability, although some schools occasionally were willing to bend traditional placement criteria to encourage lower-achieving students to take more rigorous mathematics coursework. While it is true that tracking at earlier grade levels may limit the numbers of students eligible to take college-preparatory mathematics coursework, the end result is that many students are denied access to important mathematics experiences which would prepare them to pursue the study of mathematics and science beyond high school. The study also found that schools often place their least qualified mathematics teachers in low-ability classes and their most-qualified teachers in their high-ability classes, particularly at the secondary level.

Finally, the study found that even when mathematics course titles are the same, the curricular goals emphasized by the teachers and the instructional strategies they employed to meet those goals differ in ways that lead to unequal opportunity to learn mathematics. For instance, it was found that high-ability groups at the elementary, middle, or junior and high school levels progress further in the school curriculum over the course of the year than low-ability groups. It was also found that lower-level courses expose students to fewer mathematical topics and skills as well as less-demanding topics and skills. High-ability tracks typically include more complex material and more difficult thinking and problem-solving tasks. In addition, teachers of high-track students reported spending more time preparing for class, and they appeared to be more enthusiastic and more willing to push their students to stretch academically than teachers of low-track students. Upper-track teachers also expected their students to spend more time on homework than did teachers of low-track students.

Similar qualitative differences in the mathematics instruction available to students in high- or low-track classes is borne out in other research as well. For example, an examination of the middle school mathematics instruction in six different school districts found that in most districts a clear tracking hierarchy existed. Low-track students received a more limited curriculum and engaged in less favorable interactions with the teacher than did their high-track counterparts (Ekstrom & Villegas, 1991). It is worth noting that even within the same classroom, differing patterns of interactions between teachers and high- and low-ability students have been found. With regard to mathematics instruction, a case study of one particular classroom showed that low-ability students received less teacher time and were asked a fewer number of process-oriented questions (Leder, 1987).

EFFECTS ON MATHEMATICS ACHIEVEMENT

The NSF study described earlier (Oakes, 1990a) did not specifically examine the relationship between tracking and achievement in science or mathematics. However, a

substantial body of research suggests that tracking, especially at secondary schools, generally fails to increase learning and has the unfortunate consequence of widening the achievement gaps between students judged to be more able or less able (Cole & Griffin, 1987; Eckstrom & Villegas, 1991; Gamoran & Berends, 1987; Slavin, 1987a, 1987b, 1990). Studies examining the effects of homogeneous grouping on achievement tend to take two approaches: (1) comparisons of the achievement of students in heterogeneous classes with comparable students in ability-grouped classes or (2) comparisons of the achievement of students in different ability groups.
This distinction in the design of the research reported is an important one. Given the varying opportunities to learn mathematics in the different tracks one would clearly expect to find differences in mathematics achievement as a consequence. Therefore, it is not a surprise that achievement differences in mathematics due to tracking have been found even controlling for ability level, socioeconomic status, and a variety of other variables (Gamoran & Berends, 1987).

In reviews of research comparing the achievement of students in heterogeneous classes with comparable students in ability-grouped classes, few differences in achievement have been found. In particular, a meta-analysis of studies examining the effects of ability grouping on achievement of secondary students (middle, junior high, and high school) reported that in comparisons of ability grouping and heterogeneous grouping over periods of from one semester to five years, overall achievement effects were found to be essentially zero at all grade levels (Slavin, 1990). A similar meta-analysis for elementary students also showed that overall effects of ability grouping on achievement were negligible (Slavin, 1987b). Both meta-analyses refute the claim that ability group is good for high-achievers and bad for low-achievers which has often been asserted.

Interestingly, the only exception to these findings was when students from heterogeneously-grouped classrooms were regrouped homogeneously by reading and mathematics achievement scores for reading or mathematics instruction (Slavin, 1987a, 1987b). Here, the research has been inconclusive, with several studies of regrouping for mathematics instruction showing that homogeneous regrouping had positive effects on mathematics achievement when materials appropriate for the student's level of performance were used (Provus, 1960; Morris, 1969).

EFFECTS OF RESEARCH ON TRACKING PRACTICES

In spite of the findings that homogeneous grouping seems to have little effect on achievement, some level of tracking persists in our public school system, particularly at the middle and high school level:

"While most people (including many educators) assume that students will learn better if they are grouped together with those who have similar capabilities, research has shown that putting children into separate classes to accommodate their differences from earliest school years is neither necessary nor very effective. Tracking does not work well for students in the low- and midde-ability groups, who experience clear and consistent learning disadvantages. (T)rack does not necessarily promote achievement for high-ability children either. Many studies show that highly capable students do as well in mixed ability classes." (Oakes, 1990a, p. 6)

Oakes has suggested that the persistence of tracking in the public school system is based on several assumptions: (1) that students learn better when they are grouped with other students who are considered to be academically similar; (2) that students develop more positive attitudes towards themselves and school when they are not placed in groups with others who are more capable; (3) that placement processes used to separate students into grouping both fairly and accurately reflect past achievement and native abilities; and (4) that it is perceived as easier for teachers to accommodate individual differences in homogeneous groups (Oakes,1985).

The persistence of homogeneous grouping is particularly troubling given the long-term effects on female and minority students, both groups of whom are dramatically underrepresented in the mathematics and science areas. The tendency to place minority students in lower tracks has been described by Cole and Griffin (1987) in their discussion of ability-grouping research:

"There have been many accounts of differential treatment in ability groups reported by researchers who have examined classroom interactions closely...These researchers report that the distribution of students to high, middle, and low ability groups seems to be related to characteristics associated with SES: Children from low-income or one-parent households, or from families with an unemployed worker, are more likely to be assigned to low ability groups. The work by Cicourel and Kituse (1963) suggests that children from low income families with low grades and low test scores could be tracked higher, particularly because of parental intervention. The more telling finding...is that children from low income families with adequate test scores and low grades were placed in a lower group, while corresponding children from middle income families were placed in a middle level group. (p. 21)

Females, because they are sometimes seen as less able mathematically or because they express less interest in mathematics and science, may also be inappropriately placed in lower tracks, particularly at the secondary school level (Oakes, 1990b).

Recent assessments in mathematics achievement suggest students in the United States are not generally strong in mathematics, with too few students, especially minority and female, studying higher level mathematics. The reform literature in mathematics education argues strongly for the need of a quality mathematics education for all students. In the descriptions of exemplary classroom practice there is a strong focus on diversity of approaches (NCTM, 1989, 1991; RAC, 1989). Is it too much to hope that as school districts adopt approaches which are congruent with recent recommendations for mathematics education reform the practice of homogeneous grouping will no longer be felt to be necessary?

REFERENCES

Cole, M., & Griffin, P. (1987). Contextual factors in education: Improving science and mathematics education for minorities and women. Madison, WI: Wisconsin Center for Education Research.
Ekstrom, R. B., & Villegas, A. M. (1991). Ability grouping in middle grade mathematics: Processes and consequences. Research in Middle Level Education, 15(1), 1-20.

Fullilove, III, R. E. (1987). Images of science: Factors affecting the choice of science as a career. Educating scientists and engineers: Grade school to grad school. ED 297 961

Gamoran, A., & Berends, M. (1987). The effects of stratification in secondary schools: Synthesis of survey and ethnographic research. Review of Educational Research, 57, 415-435.

Hassell, J., & Armistead, J. (1991). Meeting national goals for 2000 and beyond in mathematics education. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education. ED 335 210

Leder, G. C. (1987). Teacher student interaction: A case study. Educational Studies in Mathematics, 18, 255-271.

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.

Oakes, J. (1985). Keeping track: How schools structure inequality. New Haven, CT: Yale University Press.

Oakes, J. (1988). Tracking in mathematics and science education: A structural contribution to unequal schooling. In L. Weiss (Ed.), Class, race, and gender in American education. Albany, NY: State University of New York Press. ED 342 822

Oakes, J. (1990a). Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and sciences. Santa Monica, CA: Rand Corporation. ED 329 615

Oakes, J. (1990b). Opportunities, achievement, and choice: Women and minority students in science and mathematics. Review of Research in Education, 16, 153-222.

O'Neil, J. (1991). Raising our sights: Improving U.S. achievement in mathematics and science. Alexandria, VA: Association for Supervision and Curriculum Development. ED 342 651

Pisapia, J., & Gross, E. (1991). 1990 national assessment of educational progress in mathematics: Analysis and interpretive remarks on the state of mathematics achievement. Richmond, VA: Metropolitan Educational Research Consortium. ED 342 633

Reuman, D. (1989). Effects of between-classroom ability grouping in mathematics at the transition to junior high school. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA. ED 306 102

Slavin, R. E. (1987a). Ability grouping and its alternatives: Must we track? American Educator, 11(2), 32-36, 47-48.

Slavin, R. E. (1987b). Ability grouping and student achievement in elementary schools: A best evidence synthesis. Review of Educational Research, 57, 293-336.

Slavin, R. E. (1990). Ability grouping and student achievement in secondary schools: A best evidence synthesis. Review of Educational Research, 60, 471-499.

Sullivan, P., & Clarke, D. (1991). Catering to abilities through "good" questions. Arithmetic Teacher, 39(2), 14-18.

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