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International comparative study of motivation: a commentary

Jacquelynne S. Eccles[1]

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Abstract
In this commentary, I focus on an international, collaborative, longitudinal study of the development of elementary school students' math motivation and performance across six countries: Norway, Sweden, Finland, Estonia, Portugal, and Serbia. The investigators designed motivational questionnaires to assess student motivational beliefs defined quite broadly, teacher and student questionnaires to assess teacher beliefs and practices, and family questionnaires to assess parents' beliefs and practices as well as perceptions of their children and then tested to reliability and validity of these measures across all six countries so that they could investigate both development within countries and generalizability across countries. I focus my comparative comments on the following themes that cut across the various studies: the gender, national and SES differences, the impact of teacher beliefs and practices, the impact of parents, and the testing hypotheses derived from various social cognitive motivational systems.

Keywords Motivation; Comparative perspectives · Teachers · Parents · Gender · Primary school

I felt very honored to be asked to write this commentary. The research teams responsible for the papers in this special section have accomplished a major goal by creating an international, longitudinal study of the development of elementary school students' math motivation and performance across six countries: Norway, Sweden, Finland, Estonia, Portugal, and Serbia. The investigators designed motivational questionnaires to assess student motivational beliefs defined quite broadly, teacher and student questionnaires to assess teacher beliefs and practices, and family questionnaires to assess parents' beliefs and practices as well as perceptions of their children and then tested to reliability and validity of these measures across all six countries so that they could investigate both development within countries and generalizability across countries—exactly the kind of comprehensive project being called for in this field of study. We owe these researchers a great debt of gratitude for creating these data sets. The papers presented in this special section represent only the

✉ Jacquelynne S. Eccles
jseccles@uci.edu

[1] University of California, 2068 Education, Mail Code: 5500, Irvine, CA 92697, USA

first collection of results on only the first wave of data collection. Thus, although preliminary, these papers already show us the power of these data sets to investigate a wide range of topics and give us a hint at the future power of the data sets to investigate many very important causal hypotheses about the development of children's math motivation both at home and in school during the mid-elementary school years in Western, modern societies. To the extent possible, I organize my comments around themes that cut across papers.

Gender and SES

Most generally, the stereotypical gender differences in math motivation still hold across each of these countries. In 1979, I began my career with a set of studies addressing the question: Why are females less likely than males to go into math-related high school and college courses and majors and then into math-related careers? My colleagues and I proposed the Eccles et al. Expectancy-Value Theoretical Model of Achievement-Related Choices to guide the next 40 years of our research on this topic. In this model, we proposed that gender differences in motivational beliefs related to one's math competencies, success expectations, and perceived interest, utility, and attainment values and costs are the primary predictors of gender differences in math academic and vocational choices. Years of research by people all over the world supported these predictions, and many Western countries made major investments in interventions designed to reduce these gender differences in motivational beliefs. Yet, here we are in 2023, and the gender differences in these beliefs and their predictive importance remain across all six of these countries, larger in some than others but still evident in every country. Why? We know these interventions do reduce the magnitude of the gender differences in these beliefs in the short run but, apparently, they have not been able to substantially reduce them over time, despite the fact that major gender differences in math performance in courses and on standardized test have been substantially reduced.

Student SES and class level average SES were investigated by Haataja, Niemivirta, Holm, Ilomanni and Laine (this issue), Leiijen, Baucal, Pikk, Uibu, Pajula, and Sormus (this issue) and Radišić, Buchholtz, Hansen, Liu, and Kaarstein (this issue). Although student level SES in Haataja et al. had both direct associations with test scores and indirect effects through the association of student SES and student expectations for math success, class level SES did not predict class level differences in expectations for success and test scores in the Finnish data. Radišić, Buchholtz et al. (this issue) only looked at student SES at the class level. They found that it predicted reduced belief in progressive math teaching strategies in Finland, Sweden, and Serbia at level 2 (class level) and some evidence of a moderating association between gender and utility value at Level 1 (student level) in Norway and between gender and enjoyment of math in Finland. Finally, in Estonia (Leijen, Baucal, Pikk, Uibu, Pajula, & Sõrmus, this issue), student SES and Estonia language use at home were associated positively with students' math competency beliefs, perceptions of the classroom as agency supportive, and student sense of agency.

Impact of Teacher Beliefs and Practices

Four of the articles, Radišić, Buchholtz et al. (this issue); Radišić, Krstić et al. (this issue); Haataja et al. (this issue), Leijen et al. (this issue) used a two-level SEM approach to investigate the potential role of teacher beliefs on students' math-related motivational beliefs

and math performance. Like many other similar attempts in the field, class level teacher influences were small to non-existent, even though the methodological and theoretical sophistication apparent in these studies is much higher than when I began my own classroom studies. Again, like many other studies, most of the variance in these students' beliefs was located at the level of the student within classrooms rather than at the between classroom or teacher level. This generalization is even true for students' perceptions of their math teachers' beliefs.

I found this pattern quite disappointing. I want to believe that teachers can be a powerful force of good in classrooms. Qualitative studies and personal memories suggest they can be. So why do these "effects" continue to look so small in quantitative studies? These patterns suggest to me that we need to consider more closely the nature of differences in the ways teachers interact with students within each of their classrooms. Do teachers treat various groups of students in their classrooms so differently that the classroom is not the correct level of social context for level 2 aggregation? If so, what is the correct level of teacher-student interactions to study? Do a student's views of their classroom stem more from observing the differential ways in which their teacher interacts with various subgroups in the classroom than from the way in which the teacher interacts with the observing student? Do students' perceptions of their math teachers' beliefs and practices differ even though the teacher treats everyone pretty much the same? If so, why? If any of these options are true, then the unit of analysis at level 2 of these sophisticated SEM models probably needs to a smaller group with a classroom than the classroom itself.

On the more optimistic side, Haataja et al. found a positive level 2 (class) association between teachers' constructivist beliefs and average within-class students' expectations (but not average class levels of test performance) for success in Finland. Although Leijen et al. (this issue) found no significant associations of teacher characteristics on class level student performance in Estonia, they did find positive associations of teachers' confidence in goal setting with students' competency beliefs, and students' view of their class being agency supportive. Both within-country studies suggest that some quite aspects of teacher beliefs and practices can have small but reliable associations with student motivational outcomes.

Impact of parents

Only one study (Peixoto, Mata, Campos, Caetano, Radišić, and Niemivirta, this issue) investigated potential parent influences on their children's math motivational beliefs. They reported findings across all the countries but did not break their report down by country. They used data gathered directly from parents. They tested a quite elaborate and theoretically complex SEM linking parental beliefs (endorsement of a fixed view of math ability and attitudes about the nature of math) and practices (cost, support, learning, and intrinsic value–focused practices) to their children's motivational beliefs (perceived math competence, intrinsic valuing of math, and cost of learning math) and math performance. Most importantly, they found a multicollinearity problem that undermines the interpretation of the association of children's motivational beliefs with their test performance, which they fixed by aggregating the student intrinsic value and perceived competence into a single factor.

Unexpectedly, but as I have seen in several other studies of parents' influence, they found negative associations between parent practices and children's approach to motivational beliefs (intrinsic value and perceived math competence) and a positive association of parental practices with children's cost beliefs. Contrary to what socialization theories predict, these findings suggest that the more parents do, the less motivated their children

are towards learning math. Is this true and if so, why? One possibility is that children are influencing parents to a greater extent than socialization theories predict. The parents may be responding to their children's low motivation and performance in math with increased attempts to get their children to spend more time on their math engagement. If so, then the causal paths run from children's behavior to parents' practices rather than the reverse. It is difficult to test this hypothesis without longitudinal data. But this project has collected the second wave of data on the students and will be able to test it in the future.

As predicted, parents' fixed beliefs about the nature of math ability was positively associated with parents' cost and structure focused practices and negatively with the children's performance and parents' attitudes toward math learning. Interestingly, it was also positively associated with parents' intrinsic value–focused practices, perhaps because these parents want to focus their children on the fun of doing math rather than math talent. By and large, their results supported predictions related to the link of parents' beliefs to parent practices and then parent practices to children's beliefs. Again, as noted by these authors, they will be able to understand these potentially causal associations much better when they can use the longitudinal data to control for prior child math performance and beliefs and test both directions of influence between parents and children.

Cross country variations

Four studies used data from all the countries: Peixoto et al. (this issue); Hansen, Thorsen, Radišić, Peixoto and Laine (this issue); Radišić, Buchholtz, et al. (this issue); Radišić, Krstić et al. Only the last three reported country-level differences in means or significance levels of associations. Because they standardized the scores at the entire population level, country-level differences in means are the clearest in DK with Norway having amongst the lowest scores both math test performance and the motivational beliefs. What I found particularly striking was the inconsistent patterns across countries in the standardized scores on the performance tests and motivational beliefs, for example in the third grade, Swedish students had the highest average test scores but the lowest perceived math competence. Furthermore, even though the basic Dunning-Kruger effect was evident in all counties, the size of the Dunning-Kruger effects varied across the countries, across quintiles of performance, and across student characteristics such as gender within and between countries. However, these basic country-level patterns replicated across grade level suggesting reliable social cultural effects.

Radišić, Buchholtz et al. (this issue) and Radišić, Krstić et al. (this issue) papers provided information about variations across countries in the associations amongst student level constructs, amongst class level constructs, and between level constructs. This information consisted of observations of the magnitude and significance of the pathways within and across levels (i.e., student and classroom levels) in each country. They did find a few country-level variations with the most significant path coefficients reflecting the moderating predictive influence of both teacher beliefs and class level behavior problems and family social class on the associations of gender with both interest and utility values in Norway. One of these moderating influences was replicated in Portugal. These were the only indications of family social class. Although these authors suggested that these differences might reflect variations in the schooling characteristics across countries, specific hypotheses about these country-level differences were not offered. Otherwise, significant pathways occurred primarily within level, and by and large, these pathways replicated across countries at level 1 (student): enjoyment of math was either directly or indirectly and significantly

predicted by interest and utility values and perceived competence and never by test scores; impacts of gender on enjoyment of math were largely mediated by the associations of gender with perceived confidence in each country; the impacts of gender on enjoyment of math were also predicted by interest value only in Estonia, Norway, and Portugal.

Testing social cognitive motivational systems

Given the design of the entire project, all the papers dealt with social cognitive processes in math motivation and performance. By and large, these papers provide solid support for the SEVT social cognitive model of both contextual and psychological influences on math-related teaching practices, parenting practices, and students' motivational beliefs and performance. Again, by and large, these studies provide such support across the six countries included in this project. I, of course, was delighted with these findings. Similarly, when tested, these studies provided good support for the importance of Dweck's fixed versus growth mindsets as well as hypotheses related to the Dunning-Kruger effect across these six countries. Furthermore, several new perspectives on social cognitive influences were suggested, e.g., an expanded view of the role of students' sense of agency (Leijen et al., this issue) and math identity (Radišić, Krstić et al., this issue). I also thought the paper by Hansen Yang et al. (this issue) on the Dunning-Kruger effect pointed out the importance of our understanding of the many sources of comparison that can influence students' own perceived math competence.

Clearly, the underlying assumptions regarding the importance of social cognitive processes in motivated behavior and school settings are important. They are both predictive of math performance and amendable, in the short run, to interventions with parents, teachers, and students. This is good news for educational psychologists and educational policy makers. But whether these types of interventions can help bring about larger more long-lasting social change in group differences in math motivation and performance remains to be seen. Such effects likely need more major changes in the educational system within and across countries.

Conclusion

Again, I thank the authors of this set of papers for inviting me to write this commentary. This is an outstanding set of papers reporting the initial findings from an outstanding international comparative project. This project has already given us (1) an excellent set of reliable and valid measures of students' motivational beliefs drawn from multiple theoretical systems and both parents' and teachers' motivationally relevant beliefs and practices and (2) a comprehensive and very interesting set of preliminary results that support the importance of social cognitive approaches to educational psychology. This set of papers illustrates how one can use their measures and the importance of integrating multiple theoretical frames in the study of the development of motivated behavior in educational settings. This special section also illustrates the advantage of bringing together sets of papers focused on similar issues with similar data sets. I am sure I learned more by studying these papers as a set than I would have by reading them in different journal at different times. I look forward to special Sect. 2 focused on the same set of topics using the longitudinal data. I also look forward to a set of papers in which the country-level differences are theorized more finely and then specific hypotheses are tested.

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Declarations

Competing interest The authors declare no competing interests.

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Jacquelynne S. Eccles. is a Distinguished Professor of Education at the University of California, Irvine. Her current research focuses on tests of her Situated Expectancy Value Theory of Motivated Behavior.

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