

**FOSTERING STUDENT AGENCY IN LEARNING MATHEMATICS:
PERSPECTIVES FROM EXPERT TEACHERS IN SHANGHAI**

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Fostering student agency in learning mathematics has been repeatedly emphasized in curriculum reforms in China since the 1990s, along with the innovation ideas such as “children themselves are the masters of their own mathematics learning, while teachers are the organizers, facilitators and collaborators of mathematics learning” were recorded in official curricula. It must be admitted that at the time it was not clear how to implement them concretely, and there were many concerns about their effectiveness in Chinese education system. For example, what can teachers do to take the lead in teaching while at the same time reflecting that students are the masters of their own learning? Besides being an organizer, facilitator, and collaborator of learning, are there any other roles that teachers need to play, and what are the primary roles of teachers? What is constructivism? Does it mean that teachers should not tell students directly, but let the learners construct their own understanding? Is the meaningful receptive learning approach more desirable as a primary way of learning mathematics? During the period 2000-2006, and especially during 2003-2005, there was a large-scale discussion and debate among mathematicians (including some Chinese mathematicians working overseas), mathematics education researchers, teacher educators, and school teachers about the new curriculum reform in mainland China.

Over nearly 30 years of practice and exploration, exemplary school teachers have gained their own insights into achieving a reasonable balance between students’ agency and teachers’ leading role. Their teaching design was initially designed for how to teach students; later, for how to teach students to learn; and in recent years, for how to teach so that students could learn actively and creatively, and they called their current class as “learning-centered class”. The purpose of this study is to contribute to the understanding of what a teacher-directed, students take ownership of their learning classroom looks like and how elementary teachers can most effectively foster children’s agency in learning mathematics.

We interviewed with 17 expert mathematics teachers from 15 primary schools in Shanghai and 4 expert teacher educators who used to be primary school teachers in Shanghai but mainly do in-service mathematics teacher training now. They are named as “expert” because 4 of them are outstanding teachers in Shanghai with the rank of professor level (the top professional title to school teachers in China) and all the others are senior level (the second high) teachers. Seven of them are also called Master (TEJI) Teacher (an honour to recognize outstanding school teachers and principals). Ten of them are males and 11 are females, with the least years of teaching being 11 years and the most being 40 years.

Through recursive analysis of the expert teachers' descriptions, we synthesized a framework for characterizing the central aspects of a learning-centered class. The framework consists of 4 dimensions, which are "full and active participation", "taking up space", "a pleasant and supportive learning environment", and "satisfied learning achievement". Each dimension is represented by 2-3 indicators. In general, all of the four dimensions were valued by the teachers, with 19 out of the 21 teachers addressing all the dimensions in their interviews, and only two teachers mentioning the other three dimensions but not "taking up space". When examining all of the nine indicators, the two most frequently mentioned by respondents were "discuss questions or ideas raised by students" (under "taking up space") and "intellectually engage in hands-on or other activities" (under "full and active participation"). The percentages of teachers who mentioned them were 90% and 86%, respectively. They are considered to be the most important characteristics of a learning-centered class in this study. The indicator "involve students in the evaluation process" (under the "taking up space" dimension) was least mentioned by the teachers.

All of the twenty-one teachers value the importance of getting students take ownership of learning and they believe teacher can contribute significantly in developing student agency. We categorized teachers' responses to the role they can play in shaping a learning-centered class into five different perspectives: mathematics teachers as architects, conductors, diagnosticians, river guides, and role models. Most of the teachers talked about their roles from four or five perspectives, meaning that they had a variety ways of leading, scaffolding and facilitating their student learning with their care and expertise. The most important expertise they shared with us was how to carefully design teaching before a lesson, including the design of teaching objectives, learning tasks, learning process, and homework for each class. The image of "mathematics teacher as conductor" was also appeared quite frequently in the teachers' responses, and only one teacher did not address it. The least mentioned image was "mathematics teacher as river guide", which refers to the teacher's ability to respond quickly and effectively to unexpected situations in class, such as adjusting lesson plans or correcting whole class discussion directions. Their opinions and strategies for solving specific instructional problems, such as how to design learning tasks to guide students to deep learning and how to artfully point out students' mistakes without hurting their sense of identity, were reported and illustrated. This study is helpful to understand how expert mathematics teachers in Shanghai foster student learning agency in a teacher-directed and learner-engaged class.