NETWORKING DESIGN APPROACHES: AROUND THE TEACHING OF MATHEMATICAL PROOF

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Short description of the Workshop Groups: organizers, aims and underlying ideas

This workshop is based on part of an ongoing research project regarding the cultural and anthropological study on the development of competencies of mathematical proof throughout of secondary school. This workshop will focus on the design of teaching, especially for mathematical proof task. For this, various designs based on different theoretical approaches will be compared and their characteristics will be considered. Therefore, the key questions of this workshop are as follows: (1) How teaching of mathematical proof can be designed with each approach; (2) What characteristics each approach has in the design process; (3) How does each approach complement the others?
In this workshop, we will consider three different approaches: Study and research paths (Q-A map) in the Anthropological Theory of the Didactic; Japanese problem-solving lesson model (so called open approach); Substantial Learning Environment. Based on the planned structure shown below, this workshop accesses the above questions by designing teaching for a common mathematical task and then comparing (networking) them. There will be cultural and theoretical differences in teaching design. In this workshop, we will inquire the possibility of new approaches to these problems through collaboration with participants.
The workshop will be organized jointly by Japan and Spain. Each organizer is familiar with each theoretical approach. In addition, the workshop will be conducted in cooperation with the following prospective contributors (project members).

Study and research paths [SRPs] are the inquiry-based teaching formats proposed by the Anthropological Theory of the Didactic. SRPs are study processes initiated by an open generating question Q stated to a community of study. These processes include moments of study (search for available and relevant information to answer the question) and research (adaptation of the found information to the specific problem, creation of new solutions) (cf. Florensa, et al., 2021). Problem-solving lesson model is a format widely used in mathematics lessons in Japan. It includes the following phases (although each label may vary): problem posing (comprehension); self-solving, refining and elaborating; and summarizing and developing. Stigler & Hiebert (1999) called it “structured problem solving”. In this workshop, we will provide a template which is arranged so that even beginners can use it (cf. Mizoguchi, 2013). Substantial Learning Environment [SLE] is a keyword of Wittmann’s perspective of the didactics of mathematics as a branch of design science. It means a didactic device or organization which fulfills the following four conditions: (1) representing central objectives, contents and principles of teaching mathematics at a certain level; (2) being relevant to significant mathematical contents, procedures and processes beyond this level, and being a rich source of mathematical activities; (3) being flexible and can be adapted to the special conditions of a classroom; and (4) integrating mathematical, psychological and pedagogical aspects of teaching mathematics, and so it forms a rich field for empirical research (Wittmann, 2001).

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References

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Mizoguchi, T. (2013). Design of problem solving lesson and teacher's assistance: Based on refining and elaborating mathematical activities. *Proceedings of the 6th East Asia Regional Conference on Mathematics Education (EARCOME6)*, vol.2, 194-203.

Stigler, J. W. & Hiebert, J. (2009). *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*. Free Press.

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Planned structure:

Insert the planned structure of the workshop in the table below. You can insert rows if needed.

Planned timeline	Planned activity	Working format /Responsible person
21:30-21:35(UTC+8) (5 min)	Introduction and overview of WSG	All participants / T. Mizoguchi
21:35-21:50(UTC+8) (15 min)	Introducing the common task	All participants / H. Hamanaka
21:50-22:35(UTC+8) (15 min×3)	Short keynotes: theoretical tools and the teaching-designs	All participants / I. Florensa, T. Mizoguchi, & K. Otaki
22:35-22:50(UTC+8) (15 min)	Discussing along with the key questions	All participants / I. Florensa, T. Mizoguchi, K. Otaki, & H. Hamanaka
22:50-23:00(UTC+8) (10 min)	Summarizing: reflections and further considerations	All participants / I. Florensa, T. Mizoguchi, K. Otaki, & H. Hamanaka

Venue requirement:

Indicate the requirement of the venue capacity and facilities here.

It can be written in English or Chinese.