Research Need:
To date, very little research on individual epistemic involvement suffices the need to capture the dynamic progress of the evolvement of individual epistemic engagement in a group setting. It is difficult for us researchers to grasp the overall process of students’ epistemic engagement in CSCL by simply tallying the frequency of messages. Against this background, we advanced our previous method using elaboration values and explored a new method, calculating Epistemic Synchronization Index (ESI), to measure the degree of synchronization of students’ epistemic involvement during collaborative problem-solving.

Theoretical Framework:
Based on three cognitive modes from Kumpulainen and Mutanen (1999), we (Ding, 2009; Ding, 2010) developed a coding system to measure students’ epistemic engagement, which was termed as “elaboration values” referring off-task, on-task and elaboration activity. Each piece of student online messages was coded into a discrete numerical value as -1, 0, or +1. We’ve discovered three collaboration patterns of students, cross, parallel, and divergent. With deeper delving into CSCL data in the past three years, we’ve recognized the limits of these visualized patterns. For instance, the determination of patterns was not normalized, which indicates that categorizing the process into patterns heavily relied on individual judgment. The distinction among the patterns was ambiguous and the categorization could be subjective. Moreover, we argued that the time sequence of the artifacts needs to be taken into consideration while measuring the effectiveness at the group level.

Methodology:
The study was conducted in the International Business School of Hanze university in The Netherlands. Two female bachelor students from the fourth year participated in seven online collaboration sessions. One was from Ukraine and the other one was from China. During the seven sessions, this dyad has received seven statistics questions. The study was carried out in an online chatting room provided by the school Blackboard system, which is a java-based and text-only chat application. Researchers used the instructor function to record all of students’ text-based messages as well as the time slots for each message.

Using Epistemic Synchronization Index (ESI) to Distinguish Gifted and Regular Students’ Knowledge Elaboration Process
Dr. Ning DING & Dr. Marca Wolfensberger
Hanze University of Applied Sciences, Groningen, The Netherlands
The full manuscript is to be published in Computers & Education!

Data Analysis:
The unit of analysis was defined as each message emerging at a recorded timeslot. Before setting out to scrutinize the content of messages, we distinguished three epistemic levels of knowledge elaboration: off-task, on-task and elaborative messages (Author, 2009, 2010). These three levels originated from the proposition of Kumpulainen and Mutanen (1999). A series of equations are developed to calculate the Epistemic Synchronization Index at dyadic and individual level, see Equation 1, 2, 3 and 4.

### Highlights
- This is a methodological exploration in terms of measuring students’ epistemic engagement during CSCL.
- The proposed method combines qualitative content analysis and sequential analysis of online text-based messages.
- Using well-developed equations, researchers are able to use an index number, ranging from 0 to 1, to quantify students’ epistemic engagement during CSCL.
- Using this Epistemic Synchronization Index (ESI), it is also possible for researchers as well as teaching practitioners to distinguish members’ knowledge evolvement within one group.

### Source: