

**BAR-ILAN UNIVERSITY**

**The Contribution of Metacognitive Support and Collaborative  
Learning to Students' Dynamic Inquiry Performances**

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## Abstract

This study is based on teaching model developed by Dr. Idit Adler – Metacognitive Collaborate Inquiry Community (Meta-CIC). This model combines between collaborative learning in-group or co-groups with metacognitive guidance during an open inquiry (Zion, Adler & Mevarech, 2015). In such process, the teacher gives only the knowledge frame and let the students choose wide spectrum of inquiry questions and approaches according to their decision. Zion et al. (2004) defined the open inquiry as dynamic inquiry learning process, which learning is a re-new and prolonged process including flexibility, observation, and consideration, as a part of changes occurring during the inquiry. The criteria of dynamic open inquiry are: procedural understanding of the process, learning as a process, changes (dynamic) and affective aspects (mental). Inquiry learning is a long and complicated process. There is an essential need to support it and there are some tools available. This study model used three tools to support the inquiry process: using learning support forum, metacognitive support, and collaborative learning. According to the constructive approach, when managing learning process in open-based inquiry learning approach it is recommended to be assisted in "inquiry community" (Lim, 2004), a community which participants teachers and students that contributed from the cooperation and interaction with their friends. The learning during assistance in the inquiry community, based on internet communication, synchronized and a-synchronized, enabled observation on one issue from some points of view, different knowledge aspects, while breaking the class limits and addition of professional consulting, different represents and variable knowledge sources (Feldman et al., 2000). Metacognitive guidance assists inquiry learning in some aspects. The guiding helps to focus the inquiry on the scientific process and not in scientific facts. Likewise, it helps the students to focus on study aims. In addition, metacognitive guidance helps students to inspect and make reflection in any step during the inquiry process. (Hofstein, Shore, & Kipnis, 2004; Wu & Hsieh, 2006). Collaborative learning promotes investigational skills (Zion et al, 2005). Discussions and negotiation help the students to clear and imagine their thinking process. That process has special value for scientific study performance because checking and analyzing the logic lane during the study is acute for the inquiry (Mittlefehldt & Grotzer, 2003). The Meta-CIC model includes two learning levels: collaborative learning in-group (CI) that refer to the interaction and natural collaborative learning occurs between pair of students who works together on the same study inquiry work, and collaborative learning

co-groups (CIC) which refer to the interaction and collaborative learning occurs between students' pairs who works on different studies.

This study examines the effect of teaching model combine metacognition in collaborative learning environment, on the students' dynamic inquiry performance as manifested in learning support forums. In the past, frequency of dynamic inquiry performances was examined in forums of students whom preform an open inquiry process includes collaborative co-groups learning and metacognitive guidance, but without diagnose the level of expression and the affect. The innovation in this study is the quantification of the inquiry performance expression in each of the four dynamic inquiry characters according to inquiry performance levels. The analysis was done using indicator that developed for this particular aim. Another innovation in this study is the analysis of the drafts and reflections that written by the students during an open inquiry process includes co-groups collaborative learning and metacognitive support.

148 exceptional students were participated in this study, 79 females (53.4%) and 69 males (46.6%), all junior high school students from the seventh and eighth grade, learning in four classes that preformed "city and environment" project in the Council for Beautiful Israel. To avoid study deviation, the chosen classes are from three different schools located in the center of Israel and defined as average socioeconomic position (according to the ministry of education scale), the students were chosen based on their high academic achievements. The students divided to four groups included 40, 40, 29 and 39 participants. Each group allocated randomly for one of the study groups that differenced by the guidance type the students exposed to: metacognitive support combined with co-groups collaborative learning (Meta+CIC), collaborative learning in-group with metacognitive support (Meta-CI – Metacognitive Collaborative Inquiry), co-group collaborative learning without metacognitive support (CIC- Collaborative Inquiry Community) and in-group collaborative learning without metacognitive support (CI- Collaborative Inquiry, control group). Each group divided to subgroups, in pairs or triplets, and each subgroup done different inquiry project and submitted final inquiry report. A total of 77 inquiry reports were submitted in the study. During the comprehensive study, the subgroups submitted to the primary investigator (PI) different drafts according to the different study stages, as well as reflection reports on each stage. These documents were collected by the investigator. Also, the internet forums conversation between the investigator and each group students in the learning accompanier forum copied and collected too. Each pair or

triplet in the forum identified as same author and defined as one measurement unit. To answer this particular study questions a criteria table was developed as special indicator. The criteria used to evaluate the dynamic inquiry performance chosen according to the four criteria of dynamic inquiry skills categorize, when there is major difference between the first three criteria – procedural understanding of the process, learning as a process and changes (dynamic, changes occur during the study), and the fourth criterion- the emotional aspects. Each of the first three criteria (procedural understanding, learning as a process and changes) divided to elevated levels according to the inquiry performance levels (1- low performance level, 3- high performance level). The performance level of specific criterion was defined based on the students' activity and independence regards the criterion- the students go independently through the study without the teachers' push, or vice versa the students proceed passively and show dependence on the advisor. Also, the level determined based on inquiry's process and component assimilation - the students wrote explanations to the steps, changes and decisions regard study procedures or time management during the study process, or alternatively worked according to teacher guidance without showing comprehension and involvement.

After the indicator closure, the correspondence between the students and the advisor was examined for each of the four groups in aspect of the indicator when every message indicated as fitting into one of the criteria, documented in excel chart. After reviewing all the messages for specific couple, a review of all the messages that coded for each criterion in every stage was done separately. At the end of the review as summing up of all the evaluation that every couple of students got during the study in every stage, for each of three criteria, procedural understanding, learning as a process, and changes, was done separately and an average score was set for each group in every one of the three criteria.

For the fourth criterion – affective points of view- the emotional aspects, after the review for each couple of students in every stage, one emotion was determined as the major and identifier emotion for them in specific criterion in the stage. At the end of the review we have done a group summing of prevalence number that all the students' couples in the group got during all study stages for every one of three optional emotions- positive, negative and challenged – individually, and an average score was set for each group in every one of the three emotions. To answer the research question, data quantitative analyze was done and at the same time a qualitative analyze of all messages was done to find unified trend and reasons for the gaps between the groups.

Study outcomes approved partially some of previous studies findings and show that metacognitive support and collaborative learning promote dynamic inquiry performance in students doing open inquiry study work although a significant affect was not proofed for all criteria. Main study findings from the **quantitative analysis** appear that regard the **procedural understanding** criterion, no significant differences were find in variance analysis but in later analysis a difference was found between the META-CIC group in comparison to the CIC group. Regard the **learning as a process** criterion significance was found between the META-CIC group in comparison to META group and also regard the **changes** versatility criterion the significance that found, was as similar as finding in procedural understanding criterion, between META CIC group to CIC group. In the aspect of **Emotion** criterion, no significant differences were found between study groups regard the positive and negative emotions but regard the challenges emotion significant difference was found between METE-CIC and CI groups in comparison to CIC group.

From **quality analysis** it appears that regard the **procedural understanding** criterion, there was differences between numbers of students that present improvement in criterion performance level during study progression in META CIC group, but no constant trend that explain the significant difference was found Regard the **learning as a process** criterion, in the quality analysis was found a difference between the number of students who present improvement in performance level of the criterion during the study progression in META-CIC group in comparison to CI control group students. The difference between the groups was characterized in aspect of the stage when students take the research lead and the reasons to do so. Regard the **Changes** criterion, the data shows that the influence of the metacognitive support and the conversation in the collaborative learning group has significant effect on student's degree of involvement and leadership of the inquiry process. In aspect of **emotional** criterion - for both study groups, the frequency of positive and negative emotional characteristic almost not existed so there is no option to study and compare between groups, on the other hand regard the "challenged" criterion there are many references in both groups, with a little gap for the META CIC group when the significant gap point between the groups was in messages wording and its background.

The Importance of the study is in the aspect of the involvement and personal responsibility levels that students preformed when they get metacognitive support and taking part of collaborative learning during the inquiry. Main study evidence point on

new insight regard the connection between metacognitive support and collaborative learning and the student's involvement levels during the inquiry process, it was found that students who got metacognitive guidance and took a part of collaborative learning, take more responsibility on the inquiry process and felt they are the driving force of the process and not lead by the teacher. This fact expressed especially in learning as a process and changes criteria. In addition, in aspect of affective points of view criterion- emotional aspects- it could be recognized that students who got metacognitive support and took part of collaborative learning reported on challenging feeling caused by the personal responsibility feeling regard the study work, and not because the willing to finish the inquiry task as an exterior work.

This study has a practical consequence. If the study results will be rechecked and approved in grater sample size, it will be appropriate to say that giving metacognitive support and collaborative learning in parallel with inquiry process will lead to active and effective involvement, leadership and responsibility taken by the students during the open-based and inquiry process.