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Contribution of Metacognitive Awareness and Collaborative Learning to Dynamic Inquiry Performance and Student-Teacher Interaction as They Reflected within On Line Forums which Support Inquiry-Based Environmental Learning.

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Abstract

This research is based on an instruction model that was developed by Edith Adler: **M**etacognitive **C**ollaborative **I**nquiry **C**ommunity (Meta-CIC). The purpose of the model is to develop environmental literacy in students as a result of conducting a process of open inquiry. Tzion and associates (2004) distinguish the open research as a dynamic learning process in which learning is a process of continuously innovative thought that has flexibility, reasoning, and reflection that are developed in the student in the course of the research. The characteristics of open dynamic inquiry are dynamic thinking, process study, procedural understanding, and emotional involvement. Open inquiry is a process in which the student is in the center. The teacher provides the background knowledge only, and enables the students to choose a wide range of research questions and approaches according to their choice. This approach invites dialogue between teachers and students in the course of the instruction. This dialogue centers on the previous knowledge of the student and his interests, compared to the new information he accumulates as a result of interaction with the teacher. In the relationship between the teacher and the student both sides play an important role. Throughout the process the teacher advices, focuses, challenges and provokes the student's inquiry (NRC, 2000). The teacher-student interaction is the main catalyzer of the study process even though the student chooses the subject of research according to his interest. In order that the student should be able to solve problems that come up during the research he must be supplied with a deep and precise explanation and analyses of the concepts that describe the stages of the research. This is also necessary in order that the student should have a broad knowledge of the process of inquiry based learning, so his research will collaborate with the accepted methodology of this form of study. These concepts

include basic scientific inquiry concepts such as: observation, measuring, validation, authenticity, objectivity and generalization.

In the model of Meta CIC, the Meta cognitive guidance is explicit and directed toward environmental literacy. The incorporation of collaborative learning is a scaffold toward developing the Meta cognition of the students. The Meta cognition and collaborative learning are two issues that are interconnected. On one hand the social interaction of the collaborative learning helps the Meta-cognition because the individual learns to supply a more precise explanation for the actions that were executed and the experiences he\she had. Perpendicularly, the ability the students develop to record and report their actions and experiences improves the collaborative learning by pooling together resources and information. This educational model combines collaborative study within the group and between groups with Meta-cognitive direction in the process of open inquiry, and therefore has potential to encourage and develop Meta-cognitive thought processes and skills (Zion, Adler and Mevarech, 2015). Since the technology for online group interaction is available, the instruction involved a-synchronic activity in forums. On line forums are a communication technology that enables written correspondence between multiple participants. It is possible to send messages to the forums, to comment on individual messages, and to attach various documents to the messages in the forum. Using this technology creates a discussion that is documented and archived. It is especially appropriate for collaborative study. Use of on-line forums enables conversations over large physical distances and allows for more intense interaction between the teacher and students similar to face to face class discussion.

To date there are no in depth studies that check the results of dynamic inquiry, how it expresses concepts from the world of research, and requests of teachers for student assistance in forums of students that are executing a process of open inquiry that

includes Meta-cognitive and community collaborative study in the context of environmental literacy. Therefore, this research has two purposes:

Checking the contribution of Meta-cognition guidance and community collaborative group study, directed toward environmental literacy, for products of dynamic inquiry and expression of concepts from the scientific world that manifest themselves in the forums that support the research discussion of students that are studying environmental issues.

In addition it will check the contribution of Meta-cognitive guidance and community collaborative group study directed toward environmental literacy regarding requests of assistance from the teacher to support the research activity of the students.

This research is part of a wider research quasi-experimental that was conducted by Zion and Adler (Zion et al, 2015; Adler et al, 2015). In this research a mixed method was used; it mixes qualitative and quantitative research methodology. In the current research 137 students participated. Amongst the students 74 were girls (54%) and 63 were boys (46%). They were students of 7^{th} grade (n=80 58.4%) and 8^{th} grade (n=57 41.6%) in middle schools in three locations in the center and south of Israel. In this research 4 of the 10 classes that participated in the general study were examined (N=10). The sample of classes was taken from those classes that were executing a research project accompanied with a non-synchronic forum in the framework of the project: "City and Environment" of the Council for a Beautiful Israel. The classes that were sampled were those that had the largest amount of messages in the forum.

Each class was placed randomly in one of four research groups that differed in the type of instruction the students received. In one there was Meta-cognitive instruction compiled with Community Collaborative Learning (Meta+CIC); Inner-group collaborative learning with Meta-cognitive instruction (Meta-CI – Metacognitive

Collaborative Inquiry); Community Collaborative Learning without Meta-cognitive instruction (CIC – Collaborative Inquiry Community); Inner group collaborative inquiry without Meta-cognitive direction (CI – Collaborative Inquiry- Control group).

The tool used in this research were the messages that were written in the non-synchronic internet discussions (hereafter: forums) by the teacher and students. These included interaction between the teachers and students while writing the research project in the course of the school year. The research focused on the discussions between the students and therefore the teachers comments were deleted from analyses of the material. In most cases the research was done in pairs. Each pair was defined in the forum as one entity.

An analysis of the messages was conducted according to three criteria: executing dynamic inquiry, concepts of the research, and requests for help. Each criterion that was detected was noted and coded according to the code table that was created. Consequently, the frequency of each type was charted for each stage of the project.

The results of the research are presented in the context of the six research questions.

1) The first related to the contribution of the Meta-cognitive guidance to the process of environmental dynamic inquiry, and the manifestation of research concepts in the forums supporting the student's work. The pattern that emerged is that groups that received Meta-cognitive instruction increased use of research concepts in the course of the research after the first measurement point, and decreased in the groups that did not receive this guidance.

2) Groups that received instruction in collaborative learning showed more procedural comprehension in their messaging than groups that did not receive this instruction.

3) Groups that received instruction in Meta cognition and collaborative learning showed more messages with dynamic criteria and procedural understanding after stage 1 than groups that did not receive both types of instruction.

4) There was no evidence for differentiation between groups that received Meta-cognitive instruction and groups that did not receive instruction regarding the frequency of asking the teacher for assistance, through the forums.

5) There was no evidence for differentiation between groups that received instruction in collaborative learning and groups that did not receive such instruction regarding asking the teacher for assistance through the forums.

6) There was no difference between groups that received both forms of instruction and groups that received only one form of instruction in connection to the frequency of applying to the teacher for help through the supporting forums.

Despite analyzing the dynamic inquiry, use of research concepts, and asking for teacher assistance as they appear in the messages in the forums, the instruction model was not directed toward dynamic inquiry and not toward teaching concepts of research. Therefore the findings did not provide full confirmation for the assumptions of the research. When the instruction is directed toward Meta-cognition it is possible to see this in forums that accompany the research process (Adler, Zion, & Mevarech, 2015. Therefore we suggest as a follow up research to examine the results of these factors in groups where the instruction directs them toward this. In this form of instruction the teacher will provide tools and emphasis in the course of the inquiry on dynamic inquiry and expression of concepts from the world of research.

Concerning the assumption that there would be differences between the groups regarding approaching the teacher for help through the forums there were no findings. It is possible that if we would have expanded the criteria and checked different types of

requests for help such as: help in aspects of inquiry, help concerning aspects of Meta-cognition, or concerning collaborative learning, it would have been possible to see differences between the groups. In further research we suggest to expand the criteria "asking for teacher assistance" to include the sub criteria described.

In addition this research checked only the frequency of the use of the criteria but not whether it was used positively or negatively. Perhaps if we would have checked that aspect as well the differences between the groups would have been more distinct.

In addition, the students in this research were involved simultaneously in two types of instruction – a non-synchronic forum, and face to face. The latter type of interaction existed in all four research groups (CI, CIC, Meta, Mata + CIC). The educational guidance was executed in both the face to face and in the non-synchronic forum. Therefore it is necessary to examine the influence of the instruction model on the face to face interaction and compare it to the on line forum.