Growing Teamwork Competency: A Mixed Methods Study of an Iterative Digital Formative Assessment Approach

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Abstract: This paper reports on an intervention project, based on a digital formative assessment approach, to grow students' teamwork competency. In this intervention, a pedagogical framework and a teamwork competency measure were supported by a techno-pedagogical system. The intervention was carried out over two iterations with the same teacher and class, over two different collaborative inquiry tasks. Student participants (n=39) were in Secondary One when they started. The study employed the design-based research methodology with a convergent parallel mixed methods design. The quantitative results of students' peer-rated teamwork ratings all increased positively in iteration two while the qualitative analysis of the teamwork reflection text revealed that students had a deeper understanding of their teamwork competency. The converging findings indicate that the intervention has helped students to grow their personal teamwork competency. Implications and future work of the study are highlighted.

Introduction and background

Teamwork is one of the core competencies for the 21st Century student, yet, the mechanisms of teamwork are often complex, and assessing teamwork can be difficult (Phielix, Prins, Kirschner, Erkens, & Jaspers, 2011). This is especially as there has been less research on the metacognitive, social and emotional aspects in group work as compared to cognitive processes (Järvelä et al., 2015). Being competent in teamwork, or teamwork competency, is a multi-dimensional construct that focuses on the process of members working in a team. We focus on four dimensions of teamwork competency: coordination (COD), mutual performance monitoring (MPM), constructive conflict (CCF), and team emotional support (TES; Koh, Hong, & Tan, 2018).

While there have been many approaches to grow teamwork, a digital formative assessment approach, which refers to pedagogical mechanisms that utilize assessment for learning by means of electronic tools, has shown some promise (Phielix et al., 2011). In this paper, we highlight how students' perceptions of teamwork changed through a digital formative assessment approach. This approach was designed as a pedagogical framework, the Team and Self Diagnostic Learning (TSDL) framework (Koh et al., 2018), and supported by a techno-pedagogical system. This system had the core functions of a lesson page, ratings, visual analytic, reflections and steps-setting, and a status check page. It was implemented as part of an authentic collaborative inquiry task in a class of Secondary One students over two iterative trials. We ask, to what extent and in what ways does the approach help students to grow their personal teamwork competency? The study employed the design-based research methodology with a convergent parallel mixed methods design.

Team self diagnostic learning framework

The TSDL framework (Koh et al., 2018) is a four staged approach draw from theories such as experiential learning, socially shared regulation, and the pedagogical framework for learning analytics intervention design. It aims to build students' teamwork competency through the following staged mechanisms:

- *team-based concrete experiences* that engage students in team experiences such that they have prior knowledge and understandings of working with the members of their team.
- *self and team awareness building* primarily through making visible teamwork processes through formative assessment. This is currently enacted through self and peer ratings of their teamwork behaviors, and a visual analytic provided.
- *team and self reflection and sensemaking* that enables students to evaluate the visual analytics, diagnose their teamwork information and create new insights. Students are challenged to set specific goals to grow their teamwork individually and as a team.
- *team and self growth and change* through providing students the agency to monitor and enact the teamwork goals they have set.

Method and brief findings

Design-based research was the overall methodology. Using convergent parallel mixed methods design, quantitative and qualitative data were collected simultaneously. The focus of this paper is on the peer-rated teamwork competency scores and the reflection text that students wrote over the two iterations.

There were 39 student participants, who were in the two iterations, with the same teacher over two different collaborative inquiry tasks in the subject, Interdisciplinary Project Work (IPW). This is part of the curriculum for Secondary One and Two students. Each IPW was six months long and the intervention was designed to integrate with it. There were two cycles of TSDL in each iteration, i.e., two ratings.

We focus on the peer-rated teamwork dimensions, i.e., how a student was rated by the members in his team, as this provides a sense of how the team members perceived the participant in teamwork, a form of others-ratings. The results show that time one and two ratings for each dimension was significantly positively correlated. However, a paired samples t-test revealed no significant relationships between the dimension ratings in iteration two. Interestingly, in iteration two, there was a significant average difference between MPM scores between TSDL cycle one and two ($t_{38} = 3.324$, $p < 0.002$). On average, peer-rated MPM scores grew .23 points (95% CI [.090, .370]). For TES too, there was a significant average difference, $t_{38} = 2.990$, $p < 0.005$. Peer-rated TES scores grew .18 points (95% CI [.057, .294]).

As for the qualitative reflection text, two researchers thematically coded the text. Three themes emerged - teamwork competency shifted from head knowledge to applied knowledge, vague teamwork descriptions changed to realizations of what one has to improve on, and from general reflecting to the quality of teamwork and the collaborative inquiry task. For example, student 122ZC at the end of cycle 2 reflected on MPM, *"this dimension is important as monitoring each other helps to complete the work faster as we can concentrate better and complete work on time."* As can be seen, the reflection highlights this student's deeper understanding of the teamwork dimension in personal terms. Another student even wrote out a heuristic formula, *"no constructive conflict – [means] no interaction, [leads to] low productivity by group"*, suggesting an internalization and application of teamwork competency in the student.

Discussion and concluding remarks

A digital formative assessment approach was trialed in two iterations on a class of Secondary One students. The findings converge to indicate that the students grew in their teamwork competency perceptions. However, this change was seen only in iteration two. It could be that students were not keenly able to meta-cognitively think about and reflect on their personal teamwork competency in the first iteration. This suggests that more time is needed for students to cultivate the meta-cognitive thinking processes and language in understanding and growing their teamwork competency. Still, these findings have their limitations, and require further examination of other data sources. Also, the study has several confounding factors such as the maturity of the students, and the lack of a control group.

One key practical implication is the extent that future collaborative inquiry tasks can employ this digital formative assessment approach. A key concern would be the time needed for such metacognitive activity. This suggests the need for instructional leadership and other stakeholder support. Also, further refinement is needed to strengthen the pedagogical mechanisms and the flow of activities such that it integrates smoothly with the curriculum. Nevertheless, the findings from this study highlight that such an intervention can work to nurture the teamwork competency of 21st Century learners.

References

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