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ARTICLE

Formative assessment strategies used to support group work

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Abstract

Formative assessment strategies used during the learning process can support students when working on group assignments and mitigate challenges often associated with group work. In this two-year design-based research study, we explored formative assessment strategies used during group work in one multi-sectioned course in an undergraduate program for pre-service teachers. Surveys were conducted during the term with students and instructors to find out what types of formative assessment strategies were being used by instructors to support group work. Interviews were also conducted at the end of the term to gain deeper insights about the features of formative assessment. Findings showed that instructors were using a range of formative assessment strategies to support group work that involved making provisions for ongoing and timely feedback, leveraging technology for communications and fostering collaborative learning. This study holds significance for researchers and instructors interested in utilizing formative assessment strategies to support students when working on group assignments.

Keywords: group work, formative assessment strategies, design-based research, collaborative learning

Formative Assessment Strategies Used to Support Group Work

Group work has been extensively researched (O'Donnell and Hmelo-Silver, 2013); however, strategies used to assess learning while students are engaged in group work is still an area that needs further exploration. Working on group assignments can be challenging and often a point of frustration for both students and instructors (Berlin and White, 2012; Clarke and Blissenden, 2013; Thom, 2020). In particular, there is a need to explore formative assessment strategies used by instructors during the learning process to promote meaningful engagement and foster deep approaches to learning (Wiliam and Leahy, 2015; Gikandi and Morrow, 2016; Molloy, Boud and Henderson, 2020). Learner centred approaches where technology can be leveraged for formative assessment can be used to support interactions between students and their peers and instructors (Chanpet, Chomsuwan and Murphy, 2020). The purpose of this article is to examine the formative assessment strategies that were used by instructors in multiple sections of a teacher education course to support students when working on a group assignment.

Literature Review

We situate our study in literature related to designing learning activities that involve group work in post-secondary education courses and how formative assessment strategies and technologies can support learning-centred and collaborative learning environments.

Group Work

Undergraduate courses in education often involve learning activities that require students to work with peers in small groups and to complete a group assignment. Group work is recognized as a way to promote collaborative learning and positively impact student learning (Goddard, Goddard and Tschannen-Moran, 2007; Johnson, Johnson and Smith, 2014; Ronfeldt et al., 2015). Students work interdependently and support one another in learning together and completing their group assignments. This positive social interdependence can strengthen the collaborative learning environment for students (Friesen, 2009; Johnson, Johnson and Smith, 2014).

However, learning activities involving group work can also be problematic and challenging for both students and instructors (Berlin and White, 2012; Brown, Hartwell and Thomas, 2018). The complexities of group work have been widely researched (O'Donnell and Hmelo-Silver, 2013; Lowes, 2014; LaBeouf, Griffith and Roberts, 2016; Hammond, 2017). For example, when students are required to complete group assignments, they can become frustrated when group members disproportionately contribute to the project (Clarke and Blissenden, 2013; El Massah, 2018; Thom, 2020). Students also find it challenging to navigate the learning process and manage all the tasks involved in group work projects (Brown, Hartwell and Thomas, 2018). At the same time, instructors find it difficult to monitor student progress as they engage students in collaborative learning activities involving group work and assess group assignments (LaBeouf, Griffith and Roberts, 2016; Thom, 2020).

Assessing Group Work During the Learning Process

Assessment is often described as both summative assessment and formative assessment and both have important functions (Winstone and Boud, 2020). Ideally, summative assessment typically occurs

at the end of a sequence of learning and is represented with a grade while formative assessment or feedback is used frequently during the course to guide students in taking their next steps in learning and improving their work. Formative assessment strategies can also be used to support students during the learning process when they are working with peers (Wiliam and Leahy, 2015). Researchers have found that students in post-secondary courses experience eight times more summative assessment in their course work in comparison to formative assessment (Jessop and Tomas, 2017). For purposes of this article, we focus on the latter type of assessment that occurs during the learning process and has been shown to lead to learning gains in a meta-analysis conducted by Black and Wiliam (1998) across different education fields and levels. Wiliam and Leahy (2015) argue formative assessment strategies should be embedded during the learning process through: (1) clarifying, sharing, and understanding learning intentions and success; (2) eliciting evidence of learners' achievement; (3) providing feedback that moves learning forward; (4) activating students as instructional resources for one another; and (5) activating students as owners of their own learning. Similarly, Molloy, Boud and Henderson (2020) developed a comprehensive learner-centred feedback literacy framework that situates students as active agents in an iterative process that requires planning and feedback designs. Furthermore, combining technology and human interactions can also be used to help facilitate formative assessment strategies in collaborative learning environments (Daly et al., 2010).

Arguably, formative assessment strategies embedded in the planning and design of a course can be used to help instructors monitor the progress of the group and help support students' to take an active role during the feedback processes. Boud and Molloy (2013) describe this learner-centred approach as sustainable feedback:

> "Teachers become designers and sustainers of the learning milieu; establishing conditions in which students can operate with agency. The focus of sustainable feedback shifts from the provision of feedback to the design of learning environments, the seeding of generative tasks and the fostering of interactions between students and staff." (p.710)

Instructors use formative assessment strategies to make adjustments to the learning process and to meet the individual needs of students, needs of the group, and to tailor the learning experience to address gaps in learning (Wiliam and Leahy, 2015). Formative assessment also fosters reflective practice and is a valuable part of the learning process. The connection between reflection and assessment is often related to supporting students with becoming self-regulated learners who are able to monitor, self-assess, and generally take responsibility for their learning progress (Nicol and Macfarlane-Dick, 2006; Gikandi, Morrow and Davis, 2011; Sutton, 2012).

There are many strategies instructors use to formatively assess students and groups of students, such as creating opportunities for peers to give and receive feedback to one another during the course (Wiliam and Leahy, 2015). Peer assessment is a widely used formative strategy in higher education settings, although students hold a range of perceptions about its value towards their learning (Loureiro, Pombo and Moreira, 2012). Some students have negative perceptions of peer assessment; however, it has potential to enhance learning and increase collaboration among students provided instructors offer clear criteria, allow time for feedback, and make sure it occurs prior to summative assessment of

the work (Loureiro, Pombo and Moreira, 2012). In addition, students need to understand the purpose of formative assessment in order to become invested in the process used for formative assessment (Gikandi, Morrow and Davis, 2011; Rogerson-Revell, 2015). Understanding that peer-generated feedback can augment the feedback provided by the instructor can help students take an active role when engaging in peer feedback loops.

Recognizing that classes in post-secondary are offered in various modalities, researchers have also examined how peer feedback fits within online learning environments (Seifert and Feliks, 2019) and the need for improving the quality of peer feedback in online spaces (Loureiro, Pombo and Moreira, 2012). Peer assessment has the potential to reduce student-isolation that can arise when studying online (Usher and Barak, 2018) and provide students with more feedback when teachers are unable to do so in large or complex classes (Planar and Moya, 2016). Conducting peer assessment in online spaces can improve students' trust that the process is anonymous (an important engagement factor for many students) and allows them to more readily provide critical feedback to their peers (Seifert and Feliks, 2019). Building trust is an important part of developing students' feedback literacy (Molloy, Boud and Henderson, 2020). Technologies can be used to facilitate formative assessment strategies, such as peer feedback loops, in fully online or blended classes (Kebritchi, Lipschuetz and Santiague, 2017; Chanpet, Chomsuwan and Murphy, 2020).

Students in a Massive Open Online Course (MOOC) who engaged in peer feedback relied more heavily on their peers than students in other course offerings who relied more on instructor feedback because they had more direct contact with the instructor (Usher and Barak, 2018). Recognizing the benefits formative assessment strategies have for student learning, instructors should consider allocating more time towards this during classes (Wiliam and Leahy, 2015; Gikandi and Morrow, 2016; Bennett et al., 2017) and towards establishing collaborative learning environments (Gikandi, Morrow and Davis, 2011).

Collaborative Learning Environments

Chanpet, Chomsuwan and Murphy (2020) noted in their case study that technology played a role in facilitating formative assessment while students engaged in collaborative learning activities, such as project-based learning. They found technology provided a platform for instructor and student interactions in the learning management system (LMS) and reported students' perceptions indicated an overall satisfaction with this type of learning. Students valued personalized feedback over automated or generalized feedback when being assessed online, so instructors should be actively engaged in providing feedback (Khan and Khan, 2019). Martin (2019) recommended a number of tools for building relationships online including using video as a way for instructors and students to engage in giving and receiving feedback and argued this can mitigate feelings of disconnect or social isolation when students are learning online. In Kebritchi, Lipschuetz and Santiague's (2017) review of literature related to the issues and challenges teaching online, they recommended using audio or video feedback to foster personal connections to help build community and encourage interaction between peers and instructors in online platforms and pointed out the importance of communication and timely feedback to students. This research showed that human connection and interaction online can foster relationship building and learning activities involving collaboration.

Researchers examined student-to-student interactions in an undergraduate course where students were using technology to provide video and audio peer feedback and found when they used this technology, it provided students with a humanizing way of interacting with each other online (Bickle and Rucker, 2018). He and Huang (2017) explored students' satisfaction and perceptions of online teamwork and found that students who used a synchronous tool for communication (e.g. web conferencing) reported a higher level of satisfaction than students who used asynchronous forms of communication for collaborative work. Other technologies such as 'GroupMe', a mobile instant messaging tool, helped facilitate course discussions, small group work, and other collaborative interactions (Gronseth and Hebert, 2019). To mitigate disproportionate contributions among group members and perceived free-riding behaviours, applications such as shared digital spaces (e.g. Google docs) can be utilized to facilitate group work and also allow the instructor to monitor and discourage these negative behaviours during interactive and collaborative learning activities (El Massah, 2018). There are many technologies, both institutional and student selected, that can aid in formative assessment approaches to foster feedback and interactions between instructors and students to support group work (Brown and Thomas, 2020).

Method

Design based research (DBR) (Amiel and Reeves, 2008; Dai, 2011; McKenney and Reeves, 2018) was used to explore the formative assessment strategies used when students were working on a group assignment using three iterative phases. In the first phase, we conducted a literature review and examined issues related to group work. In the second phase, we discussed strategies to support learning in groups with all of the instructors who were assigned to teaching different sections of the course prior to the commencement of the course. The third phase took place while we were teaching the course, and this involved using the literature-informed formative assessment strategies. During the third phase, instructors and students were surveyed and then interviewed after the completion of the course. These three iterative phases were followed in both years of the study which took place in a Western Canadian post-secondary institution offering online and blended sections of an undergraduate teacher education course. Students were in their final year of a teacher education program and were tasked with an assignment where they worked in small groups (4-5 members) to co-design a unit plan. The research question that framed this part of our inquiry was: *What formative assessment strategies are instructors using to support student learning when working on a group assignment?* Even though the course was offered in blended and online modalities, the intent of the study was to examine the formative assessment strategies and was not intended to compare the sections or the modalities of the course. As such, the findings from this study are reported as an aggregate to include both online and blended sections of the course. This article reports findings specifically related to the formative assessment strategies that were used by instructors to support student learning when the students were working on a group assignment. Other results from this study were related to teacher-leadership skills and technologies used to support learning in groups and these are reported elsewhere (Thomas and Brown, 2019, Brown and Thomas, 2020).

The research team obtained ethics clearance from the university prior to recruiting participants for the study from the undergraduate teacher education course. In the first year of the study, there were 12 blended sections and two online sections of the course. In the second year, there were 12 blended sections and four online sections of the course. Each section consisted of approximately 35 students from different disciplinary specializations. Instructors from these sections were recruited first and invited to participate in the study during both years of the study. In the first year, six instructors agreed to participate in the study and in the second year, there were nine instructors who participated in the study. After instructor recruitment, the research team met with students in each section to explain the study and invite them to participate.

Mixed methods were used for data collection during this study and included surveys and semi-structured interviews. Surveys were administered to the instructors who agreed to participate in the study (Instructor participants: year 1, *n*=6; year 2, *n*= 9) and their students during the academic term when they were working on a group assignment in the undergraduate course (Student participants: year 1, *n*=210; year 2, *n*=151). The survey took approximately 10-15 minutes to complete and included questions related to the group work. The same survey was administered three times during the course to collect data at the beginning, middle and end of the term. We administered the survey three times to ensure the complete data set included all of the formative assessment strategies that were used throughout the course. This article focuses on findings related to the questions in the survey that asked students and instructors about the formative assessment strategies that were used during the course (Appendix A). Descriptive statistics were used to interpret and analyze the quantitative data from the surveys.

At the end of the term, interviews were conducted (Instructor participants: year 1, *n*=6; year 2, *n*=5) and (Student participants: year 1, *n*=9; year 2, *n*=4). The interviews took place after grades were submitted to avoid perceived conflict with participating in the study. One of the six questions asked during the semi-structured interview was about the formative assessment strategies used to support student learning when working on a group assignment (Appendix B). The responses to this question helped us gain a deeper understanding of the instructors' and students' perspectives about the formative assessment strategies that were used during the course.

The open-ended questions in the survey were analysed during two cycles of coding (Miles, Huberman and Saldana, 2014). The research team individually coded the survey open-ended responses and then reviewed these as a team. Following this review, codes were collapsed into categories. Categories were then reviewed by the research team and refined in a second round of coding. The iterative phases of DBR and analysis from year one of the study informed changes made to the instruments used for data collection. For example, after analysing data from year one, we recognized that there was an alignment between the codes that emerged during these two cycles and the literature related to formative assessment strategies and framework for feedback literacy (Wiliam and Leahy, 2015; Molloy, Boud and Henderson, 2020). The following strategies emerged from our year one data and informed our next iteration and refinements to the survey design in year two: (1) classroom activities to help students clarify, share and understand learning intentions and criteria for success, (2) provide Instructor

feedback to move learning forward, (3) classroom activities to elicit evidence of learning, (4) engineer effective class discussions, (5) activate learners as instructional resources for one another, (6) expert advice that moves learning forward, (7) activate learners as owners of their own learning and, (8) other. The same data collection approach was used during the second year of the study and participants were surveyed at three points during the course; however, the question about formative assessment was changed from an open-ended response to a multi-select response with the eight options of formative assessment strategies provided in a drop-down list.

Following the completion of the course, instructor and student participants were interviewed (Appendix B) and asked about the formative assessment strategies that were used during the course to support student learning when working on a group assignment. The transcripts from the interviews were analysed similar to the open-ended survey questions using two cycles of coding (Miles, Huberman and Saldana, 2014). Emergent themes from our analysis of the interview transcripts helped us understand how the formative assessment strategies were used in the undergraduate course. Merging the quantitative data and qualitative data gathered each year and engaging in a continual review of the data sets by multiple members of the research team, including research assistants contributed to the trustworthiness and credibility of our findings. In this article, we report the findings from year two that focus on the formative assessment strategies that were used by instructors to support student learning when the students were working on a group assignment.

Results

Surveys were administered to a total of nine instructors and 261 students in an undergraduate education course. In the survey, instructors and students reported the use of formative assessment strategies as part of the learning process used to support student learning when working on a group assignment. Table one indicates the number of student and instructor participants from the three repeated surveys that were administered at three different points during the course in the second year of the study. Since instructors (n=9) and students (n=261) could complete the survey up to three times during the course, there was an average 81% response rate for instructors and an average 36% response rate for students.

Table 1: Frequency of survey responses for repeated survey in Year 2

	Instructor Responses	Student Responses
Survey 1	9	121
Survey 2	6	100
Survey 3	7	60
Total	**22**	**281**

Both students and instructors were asked in the survey to select the formative assessment strategies that were used in the course at the point in time that the survey was administered. This question

included a drop-down list with options of formative assessment strategies and was set to allow participants to select multiple responses. Participants were also able to manually add other examples when they selected the *other* option from the drop-down list. Table 2 shows the frequency and percentages of response for the three surveys that were administered to students and instructors. In Table 2, *n* represents the total number of responses from the multi-select question. The table shows the differences between the responses selected by instructors and students at different points during the eight-week term.

Table 2: Frequency and percentages of response from students and instructors.

Note: n represents the total responses from the multi-select question.

	Survey 1 beginning of the term		Survey 2 middle of the term		Survey 3 end of the term	
Multi -Select Options	Student Frequency (%) (n=407)	Instructor Frequency (%) (n=40)	Student Frequency (%) (n=341)	Instructor Frequency (%) (n=28)	Student Frequency (%) (n=217)	Instructor Frequency (%) (n=32)
Classroom activities to help students clarify, share and understand learning intentions and criteria for success	90 (22.11%)	8 (20.00%)	68 (19.94%)	6 (21.43%)	34 (15.67%)	5 (15.63%)
Provide Instructor feedback to move learning forward	82 (20.15%)	5 (12.5%)	81 (23.75%)	5 (17.86%)	54 (24.88%)	6 (18.75%)
Classroom activities to elicit evidence of learning	28 (6.88%)	5 (12.5%)	14 (4.11%)	3 (10.71%)	18 (8.29%)	4 (12.5%)
Engineer effective classroom discussions	71 (17.44%)	7 (17.5%)	43 (12.61%)	5 (17.85%)	21 (9.68%)	4 (12.5%)
Activate learners as instructional resources for one another	51 (12.53%)	6 (15%)	57 (16.72%)	2 (7.14%)	44 (20.28%)	4 (12.5%)
Expert advice that moves learning forward	49 (12.04%)	6 (15%)	44 (12.90%)	4 (14.28%)	19 (8.76%)	3 (9.37%)
Activate learners as owners of their own learning	32 (7.86%)	2 (5.00%)	33 (9.68%)	2 (7.14%)	27 (12.44%)	5 (15.62%)
Other?	4 (0.98%)	1 (2.50%)	1 (0.29%)	1 (3.57%)	0 (0.00%)	1 (3.125%)

Table 3 provides the combined frequency and percentages for the responses from all three surveys for both students and instructors for the same multi-select survey question. Overall, the data shows that instructors were using a range of formative assessment strategies throughout the term. The purpose of collecting data at different points during the course was to include any formative assessment strategies that may have been used less frequently or only at certain points in the course. We noted that instructors reported that the range of formative assessment strategies provided in the multi-select list were used throughout the term. Likewise, students also reported that the range of formative assessment strategies were being used when working on a group assignment throughout the term. Few respondents selected *other* when responding to the survey question and few respondents manually entered a formative assessment strategy. The manually entered responses were minimal (e.g. classroom presentations, participation in D2L discussion threads with groups, expert advice, self-assessment) and did not provide any additional formative assessment strategies.

Table 3: Frequency and percentages of combined responses from three surveys.

Note: n represents the total number of responses selected in the multi-select question by participants.

Drop down list (multi-select) Selections: *What formative assessment strategies were used?*	Combined Responses from Survey 1, 2, & 3	
	Student Frequency (%) (n=965)	Instructor Frequency (%) (n=100)
Classroom activities to help students clarify, share and understand learning intentions and criteria for success	192 (19.9%)	13 (13%)
Provide Instructor feedback to move learning forward	217 (22.4%)	16 (16%)
Classroom activities to elicit evidence of learning	60 (6.2%)	12 (12%)
Engineer effective classroom discussions	135 (14.0%)	16 (16%)
Activate learners as instructional resources for one another	152 (16%)	12 (12%)
Expert advice that moves learning forward	112 (11.6%)	13 (13%)
Activate learners as owners of their own learning	92 (9.5%)	9 (9%)
Other?	5 (0.52%)	3 (3%)

Analysis of the interview transcripts with instructors and students provided detail about common features of the formative assessment strategies that were used in the courses. Three key themes

emerged from the interview data related to how the formative assessment strategies were used: (1) ongoing and timely feedback was an important feature of the formative assessment strategies used to support group work during the learning process, (2) technology was leveraged for communications when formative assessment strategies were used, and (3) collaborative learning was perceived to be supported when the formative assessment strategies were used during the course.

Ongoing and timely feedback during the learning process

During the interviews, both instructors and students discussed the importance of giving and receiving ongoing and timely feedback. The ongoing and timely feedback took place during class times when the instructor facilitated conversations and asked questions about the group assignment to prompt students to consider their next steps in the learning process. Instructors described how they allocated time to provide feedback to their students while they were working on their group assignment as part of classroom activities. The following excerpt from an interview with a student shows how instructors provided ongoing feedback to groups during classroom activities:

> "[The instructor] would have us speak to one another and then share back with the group, or work in our small groups. [The instructor] would come around whenever we were working on our showcase project, and ask questions as we were doing that. [The instructor] would make some suggestions. [The instructor] would share resources of their own with us, just to give us ideas, encourage us in our own questioning and conclusions." (Student 2)

Students shared how instructors engaged in conversations during the classroom activities to offer explicit and specific feedback on their group assignments during class to give them the opportunity to clarify criteria for success and improve work. A sample quote from a student described how students perceived the ongoing instructor feedback during classroom activities:

> "In the course of class time [instructor] would come and review our work, discuss it with us, and then give us feedback on how to improve on our work. [Instructor] also gave a lot of written feedback for our written submissions. [Instructor] would give us feedback on how to correct it. We could decide if we wanted to incorporate it or not and how that would move us up. We knew where we were standing, and we knew how to improve it. Just being explicit and being very specific in what needed to be done." (Student 1)

Instructors discussed how they engineered discussions with groups by asking open-ended questions to help groups reflect on where they were at in their learning. Discussions were used as a way to provide instructor feedback and to help guide students in making decisions about their next steps in the learning process. Instructors also discussed how they invited experts as additional resources to support students by giving them feedback on their work. Likewise, students commented on the value of sharing their work with an audience outside of the class as shown in the following excerpt from one of the interviews with a student: "its information from a designer who is professional at doing this job...so our final work was looked at by a designer that could give us more confidence with our final product" (Student 4).

Technology leveraged for communications

Technology was described by instructors and students during the interviews as a way to support communications during classroom activities using formative assessment strategies. The interviewees

explained how technology was leveraged by both instructors and students to give and receive instructor and peer feedback. For instance, online shared documents (e.g. Google documents) were used by instructors to ask students questions about their work: "I would be online with them at the same time, and I would be adding my questions as they were generating ideas through their unit plan" (Instructor 1). Students also referred to using shared online documents to support feedback and communication between group members. When asked about the challenges of doing group work, shared online documents were often described by students as a way to manage challenges in group work and aided them in being instructional resources for one another and giving each other feedback about their contributions to the group assignment. In the following excerpt a student described how shared online documents were used:

> "I think it was very manageable, because we had Google docs. So, we go in there and put all our information in properly, organized in a way that made sense…. helped with ideas and to write messages [to each other]." (Student 4)

Other technologies that were commonly leveraged for formative feedback included tools in the Learning Management System (LMS). During the interviews, participants shared how the discussion tool within the LMS was used by instructors to help students manage their group work. Instructors described how incorporating the use of the discussion tool in classroom activities helped communicate expectations of accountability to the group members and activate learners as owners of their learning. An excerpt from the following instructor interview illustrates how the discussion tool was used to help groups manage their roles in the group and helped the instructor respond to and work with individual students to elicit evidence of their learning:

> "Posting things on the discussion board... was effective in terms of outlining specific roles and then particular students would choose roles in their group and then have an accountability piece, so they'd have their name beside that, not that they were the only people who did that part of the project...but they were the lead on it….then it allowed me time to meet with those specific role leaders." (Instructor 2)

The instructors discussed how the LMS was commonly used by groups to manage their project and facilitate communication among their group members; however, instructors also noted that students used other communication technologies outside of the LMS:

> "So, I think [LMS] was the one [technology] that all had in common, but each group had designed their own working processes as part of their group contract. So some of them were communicating, they would have a [Different Applications Listed], where they were keeping their material. So I just made sure that they had a process that worked for all of them and what they were used to for that." (Instructor 3)

Other online spaces such as collaborative blogs were utilized by instructors to offer ongoing feedback and a space for students to engage and give each other feedback during the learning process as reflected in this sample quote: "That made it a lot easier to do formative assessment because the students would write blog posts, and not only was I able to give them feedback in an easy and simple way, then they were able to give each other feedback as well, and they would have specific guiding

questions each week" (Instructor 5). Technology was also leveraged to facilitate synchronous online communications between instructors and students as another means to provide feedback:

> "So I'd meet them in [web conference application] with the groups, so we'd have some time to meet and I'd give them set times that I was there, like office hours, and they would come and give me updates, but they were also expected to do individual and group updates regularly." (Instructor 5)

Additionally, technology was utilized to gather feedback from students using surveys to check-in and communicate with students: "I also sent out multiple surveys checking in about group work... using Google Forms" (Instructor 5). Various technologies were leveraged by instructors and students to communicate and as a means to give and receive feedback when students working on a group assignment.

Collaborative Learning

In the interview analysis, it was apparent that instructors and students described formative assessment strategies as opportunities to support collaborative learning throughout the course. For example, instructors reported using conversation protocols to facilitate dialogue when engineering classroom discussions with groups, "I use lots of conversation protocols so that students can challenge their thinking and extend their thinking and clarify their thinking" (Instructor 2). Instructors also arranged classroom activities that allowed for the instructor to meet with students in the group individually to engage in formative feedback conversations "to talk about what strengths they thought they brought to the group and the different skill sets they had and how it connected to their topic" (Instructor 3). Conversation protocols for dialogue with groups and individual members of the group were described by the interview participants as ways to help elicit evidence of individual and collective strengths and how members of the group were contributing to the collaborative group assignment.

Students also recognized the importance of classroom activities that supported the group with meeting their goals. For example, students noted the development of a group contract, project timeline, identifying individual commitments towards the group project, and recognizing the strengths of group members helped the group meet their goals and possibly helped mitigate challenges in collaborative learning. The following excerpt described common ideas shared by the participants:

> "I think there are always challenges, but none of the challenges were unmanageable. The main thing for us was that we had that really good foundation with the group contract that we reviewed with the instructor in class, [who] supported us in developing. But we had a timeline to submit by that we all had input into, so people took it seriously and then we were set up with the help of that, to really be aware of who was doing what, what strengths we brought. We worked so hard at that that we got to know each other quite well, so people were able to be frank and authentic in follow-up conversations throughout the project." (Student 2)

The interviewees discussed classroom activities that activated learners as owners of their own learning through self-reflection, "to actually structure time for them to be able to use the rubric and look at what they had accomplished so far and what they thought might be next" (Instructor 3). Instructors discussed how self-assessment helped support groups that were not functioning well and experiencing challenges

with collaborative learning. Students were asked to reflect on their individual contributions during the self-assessment activities:

> "I have asked all of them to do a self-assessment, because it sort of incorporates that collaborative design process in the bottom part of the rubric there. And so I've asked them all to do a self-assessment as part of LT1, and provide me with a rationale about why they have ranked themselves where they have, and then give me a reflection about that, as well as using those three guiding questions that we have for the third reflection...So that is really helpful to me, particularly with those groups that struggled to work together." (Instructor 1)

Similarly, the students who were interviewed also recognized that reflection contributed to their collaborative learning.

The interviewees also discussed peer feedback loops and how these helped students refine their group assignments and contribute to collaborative learning during the course. It was apparent that peer feedback was a routine practice that was paired with instructor feedback and this can be seen in the sample quote: "I think there was definitely check in points along the way where we sort of presented ideas and then peer feedback or discussions with [the instructor] about like where we were at and [the instructor] giving us feedback (Student 3). Likewise, instructors reported how students were using peer feedback to make improvements to their work: "how I know that was really effective was because I saw evidence of people using the feedback that they got from peers and used it, integrated it into their unit plan. So I thought that was very powerful" (Instructor 2). Peer feedback activities took place during class time as described by the following participant:

> "We had a day that was scheduled, that would be a feedback day, so everybody was to remind themselves about the rubric. Each group was to think about a question or an area where they might specifically like feedback… I did them in two or three groups together then that was addressed first and then the other group had the opportunity to offer additional feedback on things that they wanted to." (Instructor 3)

Overall, the interviewees described classroom activities that helped foster collaborative learning such as engaging in ongoing conversations around group work, facilitating dialogue with conversation protocols to clarify thinking, eliciting evidence of individual strengths and contributions to group work, helping groups organize and manage their group assignments to mitigate challenges, incorporating reflection in formative assessment strategies used during classroom activities to foster individual accountability and create opportunities for peer feedback loops to refine group work.

Discussion

Our objective in this study was to explore the formative assessment strategies used by instructors when students were working on group assignments. Our findings from the surveys showed that instructors in this study reported they were using a range of formative assessment strategies at different points in the term and students also noticed the use of a similar range of strategies used during the course. The interviews conducted with instructors and students following the course extended our understanding of the survey data and revealed three key features of the formative assessment strategies that were used when students were working on a group project: (1) ongoing and timely feedback was provided during

the learning process (2) technology was leveraged for communications, and (3) collaborative learning was fostered throughout the course. In this section, we discuss the three distinctive features of formative assessment strategies that supported students when working on a group assignment.

Feature 1: Ongoing and Timely Feedback

Instructors used formative assessment strategies that provided opportunities for giving and receiving ongoing and timely feedback when students were working on their group assignment. Wiliam and Leahy (2015) argue that this type of feedback helps to support learners as it is used to identify gaps in learning and when asking probing questions, instructors, peers or outside experts can help inform students and their group about possible next steps to improve their work. Instructor feedback was provided while students were working on their group assignments during class time and in physical and online spaces (Daly et al., 2010). These opportunities for feedback also served as a means for instructors to monitor individual contributions which can be difficult when supporting students in completing their group assignments (LaBeouf, Griffith and Roberts, 2016; Thom, 2020). Ongoing and timely feedback was described by the participants as a way of fostering student agency (Boud and Molloy, 2013).

Reflection activities, including self-reflection helped students monitor their individual and group progress in relation to the criteria for the group assignment (Gikandi, Morrow and Davis, 2011). Students discussed how they reflected on the feedback allowing them to monitor their progress and take responsibility for their learning progress. Groups were able to make adjustments to their work and determine their next steps after engaging in self-reflection. This connection between reflection and formative assessment strategies is also noted in the literature (Nicol and Macfarlane-Dick, 2006; Gikandi, Morrow and Davis, 2011; Sutton, 2012). Furthermore, it is possible the range of formative feedback strategies used by instructors throughout the course may have helped mitigate group conflicts such as free loading (El Massah, 2018), negotiating ideas and managing group work (Brown, Hartwell, and Thomas, 2018).

Feature 2: Technology-Enabled Communications

Groups were given personalized feedback (Khan and Khan, 2019) from their instructors that supported their learning and this was provided during class activities through conversations but also leveraged by technology (e.g. Google documents, LMS). Molloy, Boud and Henderson (2020) recommend building trust in order to develop feedback literacy and in this study, instructors routinely used peer feedback loops throughout the course in addition to instructor and other expert feedback. Peer feedback is a strategy that is widely used in post-secondary courses but not always welcomed by students (Loureiro, Pombo and Moreira, 2012). In our study, the instructors and students who were interviewed perceived the peer feedback loops to help with their group assignment and particularly when using online spaces (e.g. Google documents, LMS, collaborative blogs, email) to facilitate both peer and instructor feedback. Technology-enabled communications were noted in our study as a feature of formative assessment strategies consistent with the literature that also indicates technology can be used to facilitate formative assessment strategies (Daly et al., 2010; Chanpet, Chomsuwan and Murphy, 2020). Online spaces aided in collaborative learning and as indicated in the literature can also promote social connectedness and can build relationships (Kebritchi, Lipschuetz and Santiague, 2017; Martin, 2019).

Feature 3: Collaborative Learning

Class activities that featured opportunities to give and receive feedback fostered collaborative learning and student interactions with their instructors and with peers while working on their group assignment (Kebritchi, Lipschuetz and Santiague, 2017). Instructors in this study discussed how they were intentionally designing formative assessment strategies to help foster collaborative learning during class. These designs included the use of conversation protocols used by instructors to help students clarify their thinking. Johnson and Johnson (2008) suggested that when students help each other achieve success, this contributes to positive interdependence and can support collaborative learning. Instructors also facilitated collaborative learning opportunities for groups by having them engage in peer feedback loops during class to refine their group work (Wiliam and Leahy, 2015). This included giving groups clear criteria (e.g. assessment rubric) for them to give feedback to their peers. Loureiro, Pombo and Moreira (2012) argue that clear criteria is essential for mitigating students' negative perceptions of peer assessment and supports collaboration. Clarifying learning intentions helps promote student success in learning (Wiliam and Leahy, 2015), and this includes collaborative learning.

While these formative assessment strategies require time during class, we recognize the benefits that offering ongoing and timely feedback, leveraging technology for communications and fostering collaborative learning can have in supporting group work and recommend these strategies and distinctive features are embedded into the course when students are working on a group assignment (Wiliam and Leahy, 2015; Bennett et al., 2017).

Limitations

While our findings show that instructors were using a range of formative assessment strategies to support group work, we also recognize a limitation of this study is that it is based on one undergraduate course with multiple sections that included both blended and online classes. Wiliam and Leahy's (2015) formative assessment strategies and Molly, Boud, and Henderson's (2020) learner-centred feedback literacy framework helped inform our study; however, we recognize that further study is needed to explore how these strategies are being used by instructors teaching classes in different modalities and whether there are additional features of formative assessment strategies that can support students in mitigating group challenges and collaboratively working on a group assignment.

Conclusion

Formative assessment strategies can be used to support students when working on a group assignment and attention to key features of these strategies may mitigate some of the challenges and complexities of collaborative learning and group work. This study showed that instructors were using a range of formative assessment strategies at different times throughout the term and revealed there were key features of these strategies that supported student group work: offering ongoing and timely feedback, using technology-enabled communications, and fostering collaborative learning while students worked on their group assignment. This study can serve to inform how instructors can utilize formative assessment strategies and features to support students when working on a group assignment. Findings can benefit institutional leaders, instructional designers, and instructors who are interested in supporting

students learning in groups and using a range of formative assessment strategies throughout a course. Further research could involve more classes and institutions, and courses offered in different modalities to examine how formative assessment strategies and key features of the formative assessment strategies are being used by instructors to support group work in undergraduate course work.

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Appendix A. Survey Questions

Year 2 Survey Questions

What formative assessment strategies did you use this week? Select all that apply.

- o Classroom activities to help students clarify, share and understand learning intentions and criteria for success
- o Classroom activities to elicit evidence of learning (i.e. Exit slip - students are asked to provide a response to a question and submit to instructor at the end of class as they exit)
- o Engineer effective classroom discussions to elicit evidence of learning that allow for measurement of success (i.e. asking students questions to determine if there are gaps in understanding how to design models of interdisciplinary teaching and learning).
- o Instructor feedback provided to move learning forward (i.e. instructor meets with groups to provide feedback on their plans for developing an interdisciplinary unit)
- o Activate learners as instructional resources for one another (i.e. peer feedback loops)
- o Expert advice that moves learning forward (i.e. students provided with expert advice from someone outside the class)
- o Activate learners as owners of their own learning (i.e. self-assessments)
- o Other

Appendix B. Interview Questions

Instructor Interview Questions

1. What are some of the formative assessment strategies you use when teaching the course?
2. What technologies did you use to support group work and assignments in the course?
3. What do you see as being some of the challenges in fostering student collaboration?
4. What are the challenges in assessing group work?
5. How do you support student learning in group assignments?
6. Is there anything else you would like to add or share with the researcher?

Student Interview Questions

1. What are some of the formative assessment strategies used in your course by the instructor?
2. What technologies did you use to support group work?
3. What were some of the challenges you experienced with collaborating with other students?
4. What are some of the challenges you experienced when being assessed on the group work?
5. How was your learning supported in group work?
6. Is there anything else you would like to add or share with the researcher?