Handbook of Research on Mobile Technology, Constructivism, and Meaningful Learning

Jared Keengwe
University of North Dakota, USA

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Chapter 2
Approaches for Addressing Student Barriers to Collaborative Learning Success

Robert F. Houghton
Idaho State University, USA

Kevin R. Parker
Idaho State University, USA

Bill Davey
RMIT University, Australia

Karoly Bozan
Idaho State University, USA

ABSTRACT

Collaborative work can provide a valuable learning experience, especially for those preparing to enter the information systems workforce. There have been numerous papers that discuss various effective means of realizing the benefits of collaborative group learning, but the approach still experiences issues stemming from pragmatic environmental factors such as the non-traditional nature of many students. This chapter has identified a range of problems and reports on a longitudinal Action Research study in two universities in Australia and the United States. Over three semesters problems were identified and methods tested using various approaches. Several promising remedies to the identified problems are suggested, including the use of student profiles, ePortfolios, project milestones, and freely available online collaborative tools.

INTRODUCTION

Experience with collaborative work is essential for those intending to enter the information systems profession and is necessary to derive maximum benefit from courses, particularly courses like Systems Analysis and Design or Database Design and Implementation that involve large assignments modeled after projects encountered in the real world. While the benefits of collaborative learning and the very

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experience of working in groups have been well discussed (O'Malley, 2012; Barkley, Cross, & Major, 2014; Kaye, 2012), there are common problems that must be addressed (Boud, Cohen, & Sampson, 2014). Gregory and Thorley (2013) contend "[i]f we are to exploit group-based learning fully we need to take into account its complexity, including issues such as structure; delivery; type of material; the basics of group dynamics; extent of preparation; and extent of social interaction" (p. 20).

In this study, academics from a university in the United States and another in Australia first identified common problems of a pragmatic nature and then applied various techniques to determine their efficacy in helping to overcome those problems. Each was evaluated using Action Research principles and those that survived the analysis were refined and reused in following semesters. This chapter shares methods of dealing with each problem that have shown promise in the light of improved student performance. and alaborates on findings reported in Davey, Bozan, Houghton, and Parker (2016).

BACKGROUND

Theoretical Perspectives

Passive learning approaches like lectures and structured homework assignments are traditionally the mainstay of university education, but lectures in their traditional sense often fail to meet the demand of learners, as lectures can only function in a very limited context (Le, 2002). While students indicate that they are most comfortable with passive learning approaches, many studies have shown that students learn more and retain knowledge longer when active learning approaches such as project-based learning are used (Parker & Davey, 2011).

Therefore, many courses include large assignments modeled after projects encountered in the real world. Such active learning components often take the form of a collaborative semester project. Such projects accomplish two primary purposes:

- To provide students with an opportunity for practical application of knowledge, i.e., a hands-on component,
- To help students develop their collaborative skills.

Projects can be structured in such a way that students are engaged in tasks designed to apply the skills and content learned in class within a real-world context for learning. If planned properly, these projects capitalize on the advantages associated with active learning approaches like project-based learning, cooperative/collaborative learning, and constructivist learning.

Project-based learning is an active learning approach that organizes learning around projects (Thomas, 2000). Project-based learning is based on the premise that the most effective form of professional development is learning by doing (Von Kotz, & Cooper, 2000). Students engaged in project-based learning activities encounter complex questions and undertake projects that require them to synthesize understandings and deal with real-world issues. Opportunities to apply learning to a real-life situation help to facilitate the transfer of learning.

Cooperative/collaborative learning involves instructional methods that require students to work together on academic tasks (Hiltz & Benbunan-Fich, 1997), emphasizing students' active involvement in their own learning (Hall, Waitz, Brodeur, Soderholm, & Nasr, 2002).

Constructivist learning, on the other hand, is described by Miers (2004) as being characterized by the following:

- Learning is active and manipulative, with students engaged in interactions and explorations with learning materials.
- Learning is constructive and reflective, requiring students to integrate new ideas with prior knowledge to construct meaning and enable learning through reflection.
- Learning is intentional, providing students with opportunities to articulate their learning goals and monitor their progress in achieving them.
- Learning is authentic, challenging, and real-world (or closely modeled after the real-world), facilitating better understanding and transfer of learning to new situations.
- Learning is cooperative, collaborative, and conversational, requiring students to interact with each other to clarify issues and share ideas, to seek assistance, to negotiate problems, and arrive at solutions.

Collaborative group projects can deliver the benefits of all of the aforementioned active learning approaches. Experience in collaborative projects is required for those intending to enter many professions. Further, it is necessary to derive maximum benefit from many courses. The pervasiveness of teamwork in industry makes it incumbent upon universities to better prepare students for real-life situations. The "Ability to work in a team structure" topped the Forbes list of ten skills employers most want in 2015 graduates (Adams, 2014). Employers are seeking new hires with the skills necessary to work in teams, and it is essential that collaborative work be incorporated into multiple courses.

METHODS

Action Research (AR) was selected as the research method (Baskerville & Wood-Harper, 1996; Checkland & Holwell, 1998; Davison, Martinsons, & Kock, 2004) best suited to examine group work challenges and to assess proposed remedies.. This methodological approach "covers a broad array of research strategies that are dedicated to the integrated production of knowledge and the implementation of change" (O'Leary, 2004). AR is a systematic review process to address identified challenges and ultimately enhance a particular practice (Cochran-Smith & Lytle, 1990; Ferrance, 2000; McCutcheon & Jung, 1990; McNiff, 2002; Sagor, 1992; Shagoury & Power, 2012). AR is a collaborative, repetitive, situational methodology capable of bridging theory and practice in different organizational environments (Susman & Evered, 1978). Most significantly, AR is recognized as an effective tool for enhancing teaching methods and student learning in educational settings (Cochran-Smith & Lytle, 1993). The AR framework includes (1) the identification and investigation of problems or concerns recognized; (2) change designed and implanted in the practice with the goal of addressing the problem or concern identified; (3) the effect of change is observed and analyzed against pre-established measures to understand the impact of the change (Davey, Bozan, Houghton, & Parker, 2016). AR is often implemented as a multi-cycle process that follows the above sequential steps (Riel, 2007; Stringer, 2007), making it possible for the observed outcome to guide the refinement of the design and implementation of change. The research cycle developing new knowledge and the problem-solving cycle addressing work group challenges have ongoing and systematic interaction (Chiasson, Germonprez, & Mathiassen, 2008; Mckay & Marshall, 2001).

Relying on this interaction and its longitudinal outcomes, and taking into consideration a variety of studies focusing on group work (Fearon, McLaughlin, & Eng, 2012; Garbett, 2014; Hall & Buzwell, 2013; Hansen, 2006; Pauli, Mohiyeddini, Bray, Michie, & Street, 2008; Waite, Jackson, Diwan, & Leonardi, 2004; Wolfe, 2008) we were able to identify five problems and then propose remedies/interventions to improve the collaborative project outcomes and better equalize member contributions within and across groups. The study was initiated in 2007 when an academic from the United States visited and taught in Australia. One outcome of that visit was an effort to jointly develop teaching materials. In 2012 materials from Australia were put into use in courses taught in the USA, and materials from US courses were incorporated into courses taught in Australia. Informal observations were made throughout 2012 and 2013 and changes were made to materials between the original two academics. Effects of these changes were discussed by email and Skype over this time period. In 2015, the Australian academic visited the USA and two additional academics agreed to participate in the study. A set of common problems was identified through collaborative discussions, and experiences around these common problems were collated.

This chapter describes the problems identified and the remedies tested. We developed multiple remedies and implemented them in a variety of classes. Given that the cross-national team of authors had experience in teaching in the "other" institution, there were opportunities for the proposed remedies to be monitored by an outside academic. This discussion includes only those techniques to which the students responded positively or in which existing evidence supported the use of the technique. As a consequence, this chapter makes no claim that it addresses every problem.

The following measures were established across the five courses between Australia and the United States:

- Number of social loafers, or non-contributing students
- Depth of analytics performed by the students
- Breadth of analytical techniques used by the students during their projects
- Rate of on-time submissions
- Number of incidents in which the instructor is requested to mediate among team members
- Informal student feedback
- Peer evaluation feedback

These outcomes are not assumed to be rigorous to the extent that they are generalizable. However, they constitute ideas tested in two real-life situations over multiple iterations. All solutions were attempted over at least two semesters.

Underlying Theories

There is a variety of research streams that address teaching under the circumstances described above. Scott and Pollock (2006) identify a need for group work, stating that the predominance of teamwork in industry obligates universities to better prepare students for collaborative projects. This, however, requires that any problems associated with group work be identified and addressed. For example, Staehr and Byrne (2011) point out that team members in student groups commonly make unequal contributions. Whatley (2012) identifies another problem as a lack of commitment and participation from some individuals engaged in collaborative work. Such problems may be attributed to a variety of factors that

arise from students' contexts and environments, including human limitations in perception and processing, biases due to prior knowledge, skills, abilities, and information format preferences (Cohen, 2009).

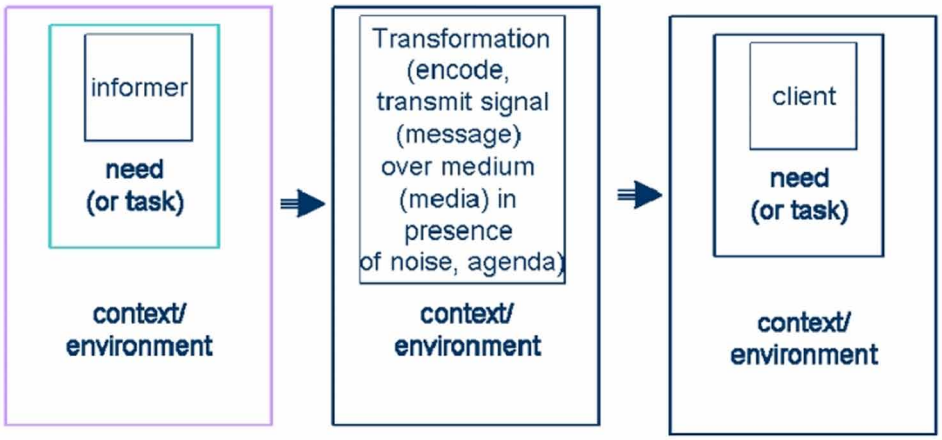
The Informing Science Framework (Figure 1) captures the complexities involved in communication along with the potential sources of those complexities (Cohen, 2009). The model has its underpinnings in Shannon and Weaver's (1949) communication model and Wilson's (1981) model, and explains three components involved in communication: (1) the informer, (2) the medium, also referred to as the channel or communications pathway, and (3) the client or receiver of the communication (Reed & Knight, 2013).

When viewed through this informing science lens, knowledge transfer is accomplished through the interaction of an informer, channel, and receiver within a complex environment (Murray & Pérez, 2015). The framework shows that information transfer occurs between the sender of a message (informer) and a receiver of the message (client) over a delivery channel (transformation over medium) through which the information is communicated (Sharp, Ryan, & Prybutok, 2014). The framework also depicts the need or task that drives the communication, along with the contextual environment of the informer, information transmission and receiving media, and receiver of information that greatly impact them.

While this transdiscipline initially focused on the direct information flow from an informer to a client, it can be applied within an educational context in which the framework relates to information flows between an instructor and a learner (Cheong, 2010). These dynamics mirror any learning situation wherein the educator assumes the role of informer, the student acts as the client, and the educational process both informs and is informed by interaction between educator and student (Murray & Pérez, 2015).

The educational context, however, includes a less obvious flow from student-to-student when it occurs in the context of collaborative work (Cheong, 2010). Project-based group work is a complex informing situation in which student-to-student informing is critical since much of the work and learning occurs in the collaborative interactions between students outside of the presence of the instructor. Hence, the transdiscipline has been modified to include these complex informing situations (Cheong, 2010). Project-based collaborative efforts require students to act alternately as "client-senders" or "client-recipients" (Gill & Cohen, 2008).

Figure 1. Expanded informing science framework
(Cohen,2009)



EXPLORING THE ISSUES: PROBLEMS EXPERIENCED IN GROUP WORK

While project-based, collaborative learning has many benefits, a variety of common problems must be addressed. Students often experience problems with collaborative learning stemming from bad habits, lack of accountability, and a variety of other factors. Some of these problems, such as those listed below, can be resolved or mitigated by proper course management:

1. Not all students share the same goals and motivation.
2. Many students have poor time management skills and a tendency to procrastinate.
3. Collaborative work on a large project generally requires that a considerable portion of the work be done outside of class, often individually. This can lead to social isolation and duplicated efforts.
4. Variations among student characteristics like accountability, work ethic, and academic ability may lead to lack of engagement, the emergence of social loafers, and the need to rework the contributions of some team members.
5. Online students require alternative means of communicating with the instructor to compensate for the lack of face-to-face interaction.

This chapter examines these problems as manifested in diverse cultures in two countries, and use Action Research to evaluate remedies used to mitigate these problems. For example, project-based learning approaches can become more effective when they involve a community of practice, which consists of people engaged in collective learning in a shared domain, where learning becomes a collaborative process of a group (Brodahl & Hansen, 2014). We'll examine how some of the problems inherent in collaborative learning can be alleviated by using online collaborative tools like shared Google Docs and wikis. Such collaborative tools share many of the elements fundamental to a community of practice, including an online presence, a variety of interactions, communication, participation, and relationships to a broader subject field of interest (Brodahl & Hansen, 2014). In addition, collaborative tools can enhance peer interaction and group work, facilitate sharing and facilitate the distribution of knowledge and information among a community of learners (Lipponen, 2002). We will also address additional approaches to help students maximize their benefit from problem-based learning.

The Environments

The two universities share a variety of characteristics that need to be understood to put the results of the study in context. First, the academics all teach information systems courses in colleges of business. Second, the courses are taught in a mixture of face-to-face and online-only modes. Third, the student populations are similar in both cases, with several students working part time and many students studying at a campus or venue that is geographically remote from the central campus of each university. These environmental factors require technological support for online students involved in any group work. The student characteristics also imply that even face-to-face students may sometimes find it difficult to be in synchronous contact with their groups beyond formal class times. The diverse nature of delivery that is common to the two institutions may contribute to the problems encountered. Both universities use a Learning Management System: the Australian university uses Blackboard and the US university uses Moodle. Although these systems provide group interaction support, the systems were both found

to be ineffective in handling the problems investigated here due to the complexity of allowing students to control sharing of resources within their group.

The Courses

The Australian courses used for the study were:

- **Digital Business Design and Innovation**: A first year undergraduate course forming part of the information systems major and minor in a Bachelor of Business degree, but also a popular elective for other degrees. This course is offered only face-to-face with a combination of interactive lectures and tutorials.
- **Internet for Business**: An elective for most of the students enrolled in the course, but also included in a specialist minor in business analysis. This course is offered only online in Australia, but face-to-face at campuses outside Australia.

The US courses used for the study were:

- **Introduction to Informatics and Analytics**: An upper division (third or fourth year) technology and application-based course designed to develop analytical and reasoning skills in the business domain. This course is required for all students with a business major. The course is taught in multiple sections, with a section being one instance of a class. While most sections are face-to-face, one of the sections is an online-only class that is required to deliver the same topics as the other sections via an "online friendly" method. Intermediate to advanced skills are introduced and assessed through projects using business scenarios and real-life transactional data.
- **Health Informatics**: An upper division course, corresponding to a third or fourth year class, that introduces the technology and infrastructure that support the clinical operations of a healthcare organization. Students from the College of Business majoring in health informatics and students from the School of Health Sciences take this class. This class was originally offered face-to-face, but in recent semesters an online-only section has been offered.
- **Systems Analysis and Design**: An upper division course that provides a general understanding of the systems development life cycle, including both traditional and object-oriented approaches, as well as the development of web-based information systems. Students from business informatics, health informatics, and computer science are required to take this course to help them develop the analytical skills required to thoroughly understand a business's software needs and formulate the optimal solution. Both a face-to-face section and an online section are offered.

PROBLEMS AND REMEDIES

This chapter discusses many practical problems encountered in incorporating group work in the aforementioned courses. Remedies were tried for many more problems than are mentioned here, but the problems discussed here were common to all of the above courses.

Problem 1

Not all students have the same goals and motivation. Some students are high achievers and want to earn an A in the class, while others are satisficers who will do the bare minimum to receive a passing grade. The dichotomy of expectations quickly leads to frustrations by both types.

Suggested Remedies

One approach to remedy this problem is to require students to fill out a profile indicating their goal in the class, what grade they hope to attain, how hard they are willing to work, whether they have a full or part time job, if they live in the local community or commute, and times when they can meet. Students sign their profile as a "contract" committing them to behave as they indicated. The instructors can then attempt to match those with similar goals and characteristics.

We also attempt to motivate students by encouraging them to develop projects of such high quality that the final product can be used to demonstrate their skills during their job search. In a variety of our courses students are required to develop an ePortfolio with the goal of showcasing the final project to current or future employees. In this way, students can demonstrate how skills learned in class have been applied in real-life situations.

The Australian contingent saw so much value in the use of ePortfolios that a similar reflective journal has become part of their assessment regime.

Problem 2

Many students have poor time management skills and procrastinate, leaving them with insufficient time to contribute to developing a quality project. Project-based online classes result in a great variation in the quality of group work submissions. A common issue is that students wait until the last minute and therefore have inadequate time to submit a well-developed, quality project, although it accounts for a large portion of their final grade.

Suggested Remedies

It is common for courses to include a comprehensive project that requires the application of skills learned in class to a real-life business problem (Kvale, 2006). Dividing the large project into a series of milestones, or deliverables, is advocated as a planning technique useful in managing large, real-world projects (Parker, 2005). Students are required to submit intermediate deliverables throughout the project, forcing them to meet deadlines or risk falling farther and farther behind.

The use of interim graded milestones can increase on-time submissions as well as overall grades. Milestones also make it possible for the instructor to determine the point at which students are experiencing difficulties and provide additional guidance. Student feedback indicates that the use of deliverables in projects makes them better able to see how all the concepts that they learned throughout the semester "fit together".

Problem 3

Collaborative work, whether part of an online class or a traditional class, invariably requires that a considerable portion of the work be done outside of class. Work outside of class is often done individually, since both traditional students and online students are time poor. Some students have no other options than to take online courses because they have time commitments that preclude full time study (Boud, Cohen & Sampson, 2014). In many cases, even traditional students are forced to take time off work in order to attend classes. Attempting to simultaneously work alone while participating in a group can lead to a variety of problems, including social isolation and redundant efforts.

Suggested Remedies

Students who focus on individually completing their portion of an assessment tasks can develop feelings of social isolation. It is rather ironic that while collaborative learning is intended to encourage students to work together, it can lead to isolation.

This problem is most effectively addressed by engaging students in a community of practice through the use of a collaborative tools, including Facebook, Google Docs, and wikis. While instructors may be tempted to address this problem using social media platforms such as Facebook, studies report that students are reluctant to use their social media accounts for school work as it infringes on their personal lives (Wang, Woo, Quek, Yang, & Liu, 2012). Our students were willing to use Facebook and Skype to aid communication, but they too were reluctant to share their work on their personal Facebook accounts, reflecting the attitudes reported in the study cited above.

A more effective alternative than Facebook is the use of Google Docs in a shared folder. Google Docs allows users to access, create, edit, and print documents from a phone, tablet, or computer, but more importantly it allows multiple users to collaborate with each other in real time. It also allows students to work either synchronously or asynchronously, allows work to be shared with the group, makes it possible for the work to be public to the group but private for all others, and even allows worked to be shared with a course tutor so the tutor can provide help asynchronously to the group. Students' reluctance to use social media for collaborative work made them even more appreciative of having an option by which they could request feedback from the tutor prior to submission.

Wikis can be extremely effective as a tool for collaborative projects. A wiki is a collaborative web site whose content can be edited by visitors to the site, allowing users to easily create and edit web pages collaboratively (Chao, 2007). Wikis are a very effective tool for project planning and documentation (Schaffert et al., 2006a), and actively involve learners in their own construction of knowledge (Boulos, Maramba, & Wheeler, 2006).

When used for collaborative projects, wikis allow students to meet virtually at their convenience and work on projects together (Byron, 2005). Even geographically dispersed project teams can use a wiki to keep in touch, share ideas, and develop the project. By consolidating all comments and ideas on one webpage, a wiki presents a clearer picture of team direction than do individual email messages (Naish, 2006).

Fountain (2005) suggests several applications of wikis in projects, including problem solving, allowing commentaries/critiques on project integration work, managing a long-term design process, permitting constructive critiques of projects, and cross class/course projects. Schaffert, Gruber, and Westenthaler (2006b) suggest ways in which wikis can be useful in managing projects, including providing a venue for

brainstorming and the exchange of ideas, coordination of activities, records of meetings, and serving as a notepad for common information items. Chen et al. (2005) note that when wikis are used to support a group project, they enable students to gather, organize, and share writing, images, videos, presentations, and other digital creations. Both Parker and Chao (2007) and Parker and Chao (2008) further examine the use of wikis as a teaching tool for collaborative project-based work. It is worth noting that many of the learning management systems now include integrated wikis, journals, and instance messaging systems.

Some facets of social isolation may also be alleviated by changes in administering projects. For example, explicitly-assessed compulsory group interaction can be used as an ice breaker to encourage initial contact and interaction with a group.

While it may seem obvious, merely establishing clear expectations among team members prior to beginning the assignment increases the transparency and accountability of each student. In addition, a tutor may be assigned to monitor the sections assigned to a particular student through the course of the semester and identify that person's possible strengths and weaknesses. This can be beneficial not only by making it possible to challenge students further in the area of their expertise but also to provide them with help with concepts that require additional attention.

The instructor may want to encourage the group to identify student strengths. Student teams could then divide the assessment exercise into sections and assign each team member an equal portion of each deliverable. Each student is not only responsible for completing their own section, but they are also required to monitor and provide feedback on teammates' contributions. When the completed project is submitted, it must include a log of which team member was assigned responsibility for each segment so that contributions can be individually assessed. In order to ensure that each student also understands other parts of the deliverable, their part needs to include an explanation of how it fits in with the overall assignment.

This approach does not require any particular technology other than a platform that facilitates file sharing. Google Docs is ideal as it provides visibility to the others' work in real time, so version control is not an issue. However, real-time interaction is not required and email communication about task designation seems sufficient, which is a benefit for online students who may have other commitments during the day.

Students attempting to work on individual portions of a group project may duplicate efforts of other team members. Students sometimes get confused as to what parts of the group project have been accomplished and by whom, so they perform redundant work, wasting time and effort. This can be addressed by using automatic versioning tools like Google Docs that allow group members to review the precise revision history of the documents and data sets. Tools that allow students to keep their copies safe from error and disaster reduce some of the stress associated with a large project. Versioning tools ensure that the document or data set that a team member is working with is the latest version, and they can easily ascertain which portions need additional attention. Versioning helps to reduce repetitive work. Students can be taught how to set up a versioning system as part of saving a document.

Problem 4

A variety of student differences, including accountability, work ethic or level of motivation, and academic ability, often become apparent when collaborating in group projects (Felder & Brent, 2005).

The first problem noted is that students working as part of a team may not feel as accountable as when they work individually. Some students fail to engage in the course and with their groups. This is

experienced in both online and face-to-face courses, but is especially common when students are located remotely and take an online course. Students unable to meet with their groups may experience decreased accountability, because those students do not face the negative peer pressure of personally admitting to their group members that they did not contribute their fair share.

The second problem is that collaborative teams often reveal slackers, or students who avoid work or effort. Face-to-face groups and online groups often report the presence of a group member who does not put in much work. Responsible students often learn this in their first group project, and henceforth are wary of teaming with people they don't know because they fear that the assessment result will reflect only the overall group effort, with no ramifications for social loafers. Some students report that they have had an excessive burden due to the desire for a good group result and poor participation by group members.

The final problem is that not all students understand course material as well as others, so their work requires more rework than the work of others. Yet the project is graded as a whole.

Suggested Remedies

Lack of accountability can be addressed through the use of peer evaluations, or peer assessments. Peer evaluations have long been an integral part of group-based work (Boud, Cohen & Sampson, 1999; van den Berg, Admiraal, & Pilot, 2006; van den Bogaard & Saunders-Smits, 2007). Each member of a collaborative team is required to submit an assessment of their teammates. All of our courses that involve a collaborative project require each student to submit a peer evaluation form. Students who fail to submit evaluations will be assessed a penalty of one letter grade on their project score. While the project is graded as a whole, each individual's grade will be determined by weighting the project grade by the results of a confidential peer evaluation. Each team member assesses the contributions of all members of the team with regard to the percentage contributed by each member toward the successful completion of all phases of the project, and the cumulative scores for each team member will be averaged. For example, if the project receives a score of 90, and team member #1 is assessed an average contribution of 80% by all fellow team members, then team member #1 will receive a project score of 72. On the other hand, if team member #2 worked diligently and received an average contribution percentage of 100%, then his or her project score will be 90.

The categories on the peer evaluation form include such areas as:

- Understanding of Class Material and Concepts Involved
- Leadership/Project Coordination
- Quality of Work (both the ideas contributed as well as preparation of deliverables)
- Willingness to assist other team members
- Availability (via phone, texting, and e-mail as well as meeting attendance)
- Follow-through (delivered what they promised)
- Amount of Input
- Research (background material as well as tools used for presentation)
- Final Project Preparation
- Overall Contribution

In addition to increasing team member accountability, peer evaluations are also useful in addressing social loafing. Another useful remedy combines collaborative tools and the use of assigned colors. A

collaborative tool like Google Docs and a shared folder can be shared by group members and the tutor. Each student chooses a color and any contributions by them are required to be in that color. Students are informed at the beginning of the project that each group member may be given an individual mark that is determined on the basis of the quality of the work done in their color. All assessment tasks (and some preliminary tasks not assessed) are created by the group using colors. As the semester progresses variations in student contributions often become evident to the group. Since the work is shared with the tutor, color-coded student contributions can be monitored, with a visual scan generally being sufficient to verify whether each color is represented in the drafts as they evolve. A typical response by the student group is a comment to be inserted in the work. If a hypothetical student "Suzy" has relationship problems that are distracting her from starting her contribution, the group can note, in Suzy's color, "if Suzy wants to contribute she can write about the software architecture here." By the third semester of using this color scheme the total number of non-contributing students in a course population of 214 dropped to 2, including one who was hospitalized and another who had a family emergency in another country. The color scheme also provides reassurance to students doing a course late in their degree who had experienced social loafing in earlier courses involving group work. It is evident that there is a mechanism in place to give individual students due credit without them doing "all the work for the group."

Differences in academic ability can also be addressed through peer evaluations and the use of color, as described above. Note that while unequal contributions may be a conscious decision, lack of understanding probably is not. Collaborative projects are intended to benefit different academic abilities. Bogler (2016) points out

Effective collaboration happens in heterogeneous groups with moderate differences in ability, personality and experience. On the other hand, grouping students with those that are a little more knowledgeable or have differing viewpoints can help the weaker students grow their knowledge and promote their cognitive development. It is important to point out that in such mixed groups, it is not just the weaker student that benefits. Advanced students improve their understanding by the mere act of teaching the subject to their weaker peers.

In any case, the use of colors will assist both the team and the grader. The team can use colors to flag sections that may require additional attention, and the grader can use colors to quickly determine which students need additional assistance understanding concepts. Peer evaluations can assist in alleviating issues surrounding the fact that the project is graded as a whole.

Problem 5

Online students require more frequent and more immediate feedback than face-to-face students.

Suggested Remedies

Online students require an effective channel for asking questions, given that there is no direct interaction with the instructor. It is especially important in courses in which technical skills are taught and hands-on exercises are assigned to students. We tested numerous techniques, which were well received by students and increased the quality of deliverables.

First, the tutor can set up a shared folder in which students are required to place all of their class-related files. This makes it possible for the tutor to monitor the progress and quality of the assignments for each student. It requires no more time than walking around in a lab session and assessing student work.

Second, screen recordings demonstrating each new concept and explaining each assignment can be provided to students. This allows students to learn concepts at their own pace and review sections multiple times as needed.

Third, responses to student questions can be recorded using screen recording software. In one of our courses the instructor accessed the students' work from their shared folder and demonstrated how the students could resolve their issues. That guidance was recorded, and those screen recordings were made publicly available for the rest of the class so others had an opportunity to learn from them as well, just as in a face-to-face classroom. The videos were clearly named and categorized, making it easier for students to find specific videos for the topics covered. This evolved into a knowledge repository that could be accessed by the class even after the semester was over.

These techniques were developed over multiple semesters in response to student feedback. The videos were very well received, and shared folders and tutorial videos were a later addition that proved to be beneficial as well. The quality of assignments and student grades became significantly better as these techniques were implemented. Student enrollment increased in the online class as well, perhaps as a result of positive student perception of the online class shared by word of mouth.

IMPLICATIONS AND CONCLUSION: A REFLECTION ON THE JOURNEY

The experience of two teaching teams across two countries shows that there are difficulties in the delivery of degrees to the modern time-poor student. These may be peculiar to the pair of institutions in which the study was situated, but may resonate with other instructors. The problems presented here are pragmatic and we expect them to be familiar to the experienced educator. For each remedy trial the team used one of the following assessments anecdotally to ascertain that a proposed solution had a perceivable desired effect:

- Number of non-contributing students
- Depth of analytics performed by students
- Breadth of analytical techniques students used during their projects
- Rate of on-time submissions
- Number of occasions when instructor is asked to mediate among team members
- Student feedback
- Peer review feedback

The instructor then reinforced the relevant aspects in the next semester. The solutions discussed above are those that showed the most positive results during the iterative trials. There is doubt that these techniques are all generalizable to any student population, but we are confident that they form a valuable set of considerations for any academic looking to find ways to address the problems posed.

CONCLUSION

The "Ability to work in a team structure" led the Forbes list of top skills employers most want in 2015 graduates (Adams, 2014). An Association of American Colleges and Universities (AACU) survey of employers found they considered a graduate's major less critical than having communication and team work skills (Jaschik, 2015). It is clear that employers are seeking new hires with experience working on teams, and it is essential that collaborative work be incorporated into a variety of courses. However, students may find the many social benefits of collaborative learning (Laal & Ghodsi, 2012) overshadowed by the problems addressed in this study. Instructors must consider remedies like those described in this chapter while at the same time fostering each student's sense of accountability and willingness to work cooperatively with others toward a common goal. Seeking and implementing remedies to the problems encountered in collaborative projects is a first step in realizing the full potential of group work.

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KEY TERMS AND DEFINITIONS

Active Learning Approaches: Teaching/learning approaches such as project-based learning.

Collaborative: Characterized by opportunities to interact with each other to clarify and share ideas, to seek assistance, to negotiate problems, and discuss solutions.

Collaborative Tool: Internet-based application that allows users to access, create, edit, and print documents from a phone, tablet, or computer and allows multiple users to work with each other in real-time.

Community of Practice: A group of people engaged in collective learning in a shared domain.

Constructivist Learning: Learning that is active, constructive and reflective, intentional, and real-world.

Cooperative/Collaborative Learning: Instructional methods that encourage students to work together on academic tasks.

Eportfolio: An online, secure, website that contain projects, papers, and other relevant course work for students to manage.

Learning Management System (LMS): A web-based application designed to organize instruction and classroom content that is accessible by both instructor and student.

Milestone: A point in a project that make it possible for the instructor to determine which students are experiencing difficulties and therefor provide more appropriate guidance.

Passive Learning Approaches: Lectures and structured homework assignments.

Project-Based Learning: An instructional method that organizes learning around projects.

Slacker: Team member who fails to contribute a proportionate amount of work toward the completion of an assignment or project.

Social Isolation: a state of complete or near-complete lack of contact between an individual and his or her peers.

Social Loafer: Team member who fails to contribute a proportionate amount of work toward the completion of an assignment or project (see Slacker).

Social Media Platform: A highly interactive tool using web-based and mobile technologies that provides individuals, communities, and organizations the means to share, co-create, discuss, promote, and modify user-generated content posted online.

Versioning: Application that give the students the knowledge that the document or data set they are working with is the latest creation, and they can easily ascertain which portions need additional attention.

Wiki: A collaborative web site whose content can be edited by visitors to the site, allowing users to easily create and edit web pages collaboratively.