The Science Behind Better Collaboration and Student Groupings and Technology

Teaching in a Digital Age

We live in an information age brought about by the reduced cost and increased ownership of personal computing technology. Technology has fundamentally changed the workplace as we know it. In contrast to previous generations, current occupational trends are towards collaborative work environments. In fact, most jobs today require some amount of collaborative teamwork. Think of significant human achievements such as building skyscrapers, developing communities, conducting space flight, eradicating diseases: only teamwork makes these possible. Furthermore, teams that span nations and even continents are not uncommon, especially since technologies such as email, wikis, intranets, and the internet have made global collaboration not only possible, but efficient. Workers must be able to work in collaborative environments, and do so in a manner that respects the values, perspectives and discourse styles of other cultures. Because collaboration is such a large part of many work environments, students will be well served to learn how to work collaboratively in school (Davis & Arend, 2013). Every year, more students arrive at school already enculturated into this technological era. The same technologies that are being used in workplaces around the world can be used effectively in collaborative classroom learning environments. A changing classroom environment is a logical consequence of a changing work environment given that classrooms are where children are prepared for the workforce.

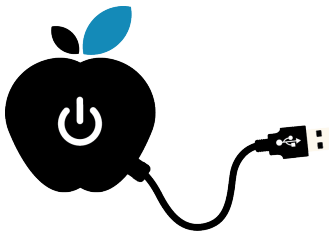
Collaborative learning refers to methods of teaching and learning that involve groups working together towards a goal such as solving a problem, analyzing information, or producing a project. Collaborative learning is most successful with loosely structured groups where learners work together towards open-ended goals (Barkley, Cross, & Major, 2005). Collaborative learning can take place anywhere, anytime because of the availability of technologies that students can access in wired classrooms and homes. An important difference between this mode of learning and lecture-style learning is the teacher is part of the learning community rather than solely an authority figure (Barkley, Cross, & Major, 2005). Teachers can encourage their students to work together to solve larger, more complex problems than they could cope with individually.

Collaboration is useful in many contexts, but especially in contexts wherein individual effort is insufficient. For example, collaboration is particularly useful for generating ideas. In fact, groups produce more ideas than the combined efforts of individuals working alone. The process of working collaboratively in a group results in the generation of a greater number of ideas (increased ideation) through its emphasis on discussion, elaboration, questioning and exploring (Davis & Arend, 2013). Collaborative learning also helps students broaden and/or change their outlooks as they are presented

with, and interact with, the varied perspectives of others. What makes collaborative learning so potent is that it provides all learners with opportunities (1) to learn from others of varying levels of subject mastery (from teachers, to all levels of student mastery), and (2) to teach others by explaining their personal knowledge and perspectives. Arguably, without collaborative learning scenarios, students might never get those opportunities.

Current educational trends and 21st century educational practices embrace collaboration. One example of this is the flipped classroom. The flipped classroom inverts the typical educational experience. Instead of receiving a lecture in class and then going home to practice, the flipped classroom uses class time for hands-on, collaborative learning activities facilitated by the teacher and home time is used for lecture presentation. This allows educators to maximize their time with students in the classroom so they can spend more time checking for student understanding and material synthesis (c.f., Hamden, McKnight, McKnight, & Arfstrom, 2013). Flipping the learners' educational experience allows teachers to pose gripping questions, problems, and challenges so compelling that students have to reach out to others (including teachers, content, and peers) to solve them using collaborative methods. This process change is extraordinarily meaningful: it captures the shift of the teachers' role as being the "sage on the stage to the guide on the side" (King, 1993).

Although 21st century educational practices such as the flipped classroom are exceedingly different from 20th century educational practices, these newer practices fit quite well with educational theories from both the 20th and 21st centuries. Combining these theories with newer discoveries in neuroscience, cognitive science and with new technologies (including email, message boards, chat rooms and text messaging, among others) allows for the creation of vastly different, and extremely powerful new learning models.



During the 20th century, learning theories and practices often focused on narrow sets of tasks with clear rules and desired outcomes. The goal of education was to transmit knowledge to students. This model often defines the student as the passive recipient of knowledge. A look at discourse patterns in classrooms exemplifies this position. For example, models of education tended towards the IRE pattern of discourse (Cazden, 1986): the *I* standing for the initiation of a question by the teacher; *R* referring to the response from the student; and, *E* referring to the teacher's evaluation of the student's response. However, the advent of the Internet and other technological advances has fundamentally changed the way people interact with knowledge. That is, rather than being passive recipients of knowledge, students must learn to be active creators of knowledge and be judges of the quality of information readily available online. Discourse patterns have also shifted as a result. Today, education emphasizes the processes of discussion,

questioning, and elaboration as tools for knowledge building. As such, 21st century learning theories and practices have shifted to emphasize the collaborative building of knowledge, rather than the simple transmission of knowledge (Harasim, 2012).

With this shift away from simple transmission of knowledge, comes a change in teacher practice. Teachers take on a facilitator role, guiding students as they become active participants in knowledge creation. Recent technological advances have afforded these changes. Teachers can encourage students to use Skype and Google Hangout to collaborate face-to-face, to use chat rooms, email and message boards to engage in collaborative synchronous and asynchronous discussions. They can also set up wikis to support students' organization of collaboratively discovered knowledge.

Although the technologies used today to facilitate collaboration were not available in his lifetime, a renowned educational theorist, Lev Vygotsky (1896-1934), foreshadowed some of the changes occurring in education today. For example, Vygotsky's sociocultural theory views children as active participants in their own learning rather than passive recipients of information. His theory considers the vital role of students' construction of knowledge even though this was not the popular sentiment of his time. Vygotsky (1962) regarded children's development as intrinsically tied to their interactions and discourse with the people around them. In essence, one could claim that Vygotsky was an early proponent of collaborative learning environments.

Other prominent educational theories, such as Albert Bandura's (1925-) social learning theory, also support collaboration. For example, Bandura contends that people learn from their social environments. Human functioning is viewed as a series of reciprocal interactions among personal factors, behaviors, and environmental events. The theory sees learning as an information processing activity in which knowledge is cognitively represented as symbolic representations serving as guides for action. Taken together, they show a common emphasis on the importance of interactions between learners and content as learners work towards constructing knowledge.

Finally, cognitive load theory (e.g. Sweller, 1988; 1994) also supports the use of collaborative learning techniques especially in conditions of high task complexity. Briefly, cognitive load theory investigates the cognitive processing requirements of learning tasks in relation to the cognitive capacity of the learner: after all, humans have upper limits on their cognitive capacities and instructional methods that overwhelm these capacities during learning will be inefficient and ineffective. Research using cognitive load theory shows that as the complexity of a learning task becomes higher, individual-based learning methods become increasingly less efficient and less effective. Although individual learning works well for situations with low complexity, such as solving simple math calculations, group collaboration is most effective when task complexity is high. This is because group

collaboration allows for divisions of labor, spreading the information-processing load across the group for highest efficiency. In the end, what the research shows is collaborative learning can be an effective method for learning complex content (Kirschner, Paas, & Kirschner, 2009).

Experimental research supports the view that collaborative learning can be exceedingly effective. For example, Prince (2004) reports that collaborative learning reduces attrition of all students and in particular increases retention of traditionally underrepresented groups, especially in STEM subjects. Others report that collaborative methods lead to increases in learning, decreases in social tensions and can result in more positive student attitudes towards school (c.f., Good, Mulryan, & McCaslin, 1992; Slavin, Hurley, & Chamberlain, 1990). Furthermore, Johnson, Johnson and Smith report two large-scaled meta-analyses of research on whether cooperative learning or individual learning methods result in better learning outcomes. They assert that over 168 research studies report evidence suggesting that collaborative learning results in higher academic achievement as compared to competitive or individualistic approaches. Additionally, they find collaborative learning results in better interpersonal relationships among and between students and faculty (Johnson, Johnson, & Smith, 1998).

In sum, collaborative learning provides students with vital opportunities to actively engage with their own learning, to connect and engage with other learners, to push discourse forward, to question and critique, and to create and build knowledge. Teachers can use existing technologies to connect with their students and to encourage collaborative learning so students can find freedom to create new knowledge. Not only will this arm students with the 21st century skills necessary to collaboratively create knowledge, but it will also engage students in a neurocognitive sense to increase the efficiency with which they learn.

Research & Innovation NETWORK

About the Teaching in a Digital Age Research

States and districts are investing heavily in educational technology, aiming for a transformational change in student learning. The crucial next step is to effectively integrate technology with instruction to improve learning outcomes. Pearson, Digital Promise, National Network of State Teachers of the Year (NNSTOY), and the University of San Diego have come together to research digital learning strategies and how they positively affect student learning. Separating tools from toys, this research strives to provide evidence-based recommendations for educators to implement in their classrooms.

Learn more at ResearchNetwork.Pearson.com

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