Routledge
Taylor & Francis Group

Journal of Education for Business

ISSN: 0883-2323 (Print) 1940-3356 (Online) Journal homepage: http://www.tandfonline.com/loi/vjeb20

Captivate: Building blocks for implementing active learning

Brent Kitchens, Tawnya Means & Yinliang (Ricky) Tan

To cite this article: Brent Kitchens, Tawnya Means & Yinliang (Ricky) Tan (2018): Captivate: Building blocks for implementing active learning, Journal of Education for Business, DOI: 10.1080/08832323.2017.1417232

To link to this article: https://doi.org/10.1080/08832323.2017.1417232

Published online: 30 Jan 2018.

JOURNAL OF EDUCATION FOR BUSINESS
https://doi.org/10.1080/08832323.2017.1417232

Routledge
Taylor & Francis Group

INNOVATIVE INSTRUCTIONAL CLASSROOM PROJECTS/BEST PRACTICES

Captivate: Building blocks for implementing active learning

Brent Kitchens[a], Tawnya Means[b], and Yinliang (Ricky) Tan[c]

[a]McIntire School of Commerce, University of Virginia, Charlottesville, Virginia, USA; [b]Dean's Office, University of Nebraska–Lincoln, Lincoln, Nebraska, USA; [c]A.B. Freeman School of Business, Tulane University, New Orleans, Louisiana, USA

ABSTRACT
In this study, the authors propose a set of key elements that impact the success of an active learning implementation: content delivery, active learning methods, physical environment, technology enhancement, incentive alignment, and educator investment. Through a range of metrics the authors present preliminary evidence that students in courses implementing these elements learn more while exerting similar effort, demonstrate greater understanding of course content, and establish closer connections with fellow students as well as instructors.

KEYWORDS
Active learning; pedagogy; student engagement

> *"Learning is not a spectator sport. Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves."* (Chickering & Gamson, 1987, p. 4)

To better engage students in learning, instructors are seeking active alternatives to the traditional lecture-based learning environment. Active learning involves a discovery process that places the responsibility of learning on the student rather than the instructor (Adler, 1982) and goes beyond memorization of facts to analysis, synthesis, and evaluation of complex problems with the potential for multiple solutions (Bonwell, 1991). The direct, one-way dissemination of knowledge, traditionally delivered through lectures, is deemphasized in favor of class discussion, problem solving, group projects, and other active learning techniques. Active learning results in higher-order critical thinking and problem-solving skills, and enhanced communication skills (P. A. Johnson, 2011), a deeper level of thinking that traditional lecture (Fink, 2013; McGlynn, 2005; Michael, 2006; Peck, Ali, Levine, & Matchock, 2006; Yoder & Hochevar, 2005), and increased student learning (Hackathorn, Solomon, Blankmeyer, Tennial, & Garczynski, 2011).

There are many active learning strategies[1] to choose from, and simply implementing one or more of them without due consideration to the context and environment of the implementation may limit effectiveness. For example, team-based learning is one way to implement active learning and provides strategies for engaging students in active learning while aligning the incentives for learning to promote both engagement and accountability (Michaelsen & Sweet, 2008). However, implementing team-based learning techniques in a traditional classroom with stationary front-facing desks without consideration of ways to improve student-instructor interaction may simply cause frustration and detract from the learning process. Careful design of active learning, while utilizing a comprehensive scheme for guiding faculty, can lead to a more effective course and more positive experiences for faculty and students. In this article, we propose a set of essential elements to be considered when designing active learning courses to engage students and to encourage students to take responsibility for their learning. While there is no one right way to design a course, the elements provided herein constitute fundamental building blocks to be considered: content delivery, active learning methods, physical environment, technology enhancement both in and out of the classroom, incentive alignment to ensure engagement and accountability, and educator investment in developing or transforming the course. Literature in higher education documents most of these elements individually, but there is room in the literature to consider how these elements work in combination. This motivates the current study.

We have known for a long time that student retention of information provided in lecture format declines substantially after even ten minutes (Thomas, 1972). In the late 1960s, Edgar Dale's research indicated that students

CONTACT Yinliang (Ricky) Tan ytan2@tulane.edu Tulane University, A.B. Freeman School of Business, 7 McAlister Dr., New Orleans, LA 70118–5665, USA.

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/vjeb.

learn more when they are engaged in active learning experiences (Dale, 1969). This means that students need to be involved in "doing" real experiences related to the content they are learning. In research that compared lecture to discussion-based classes it was determined that in "measures of problem solving, thinking, attitude change, or motivation for further learning, the results tend to show differences favoring discussion methods over lecture" (McKeachie, 1987, p. 70). Active learning integrated with content delivery outside the classroom provides a better way to reach all of the students in the classroom and better prepares them for the workplace (Felder & Silverman, 1988).

Implementing active learning effectively requires more than simply incorporating more activities into the classroom. Several other elements should be considered to maximize the effectiveness of an active learning course. In this article, we provide a scheme which defines how these elements combine to support student engagement and learning, and provide some considerations for implementing each of the elements. We first briefly describe our scheme and follow up with a detailed discussion of each individual element. After the discussion of the elements, we provide examples of the elements as they relate to implementation in three courses.

Captivate active learning building blocks

Figure 1 provides a visual representation of the elements proposed as a scheme for active learning, and Table 1 provides a practical set of items instructors interested in implementing should consider. Two central elements are content delivery and active learning methods. These elements must go hand in hand to design a course which is effective in engaging students and imparting knowledge. Content delivery may be accomplished through active learning methods, but not necessarily. Instructors may have to make trade-offs with regard to classroom time dedicated to each, or find more creative ways to deliver didactic content outside of class. In any case, content delivery and active learning should be tightly integrated.

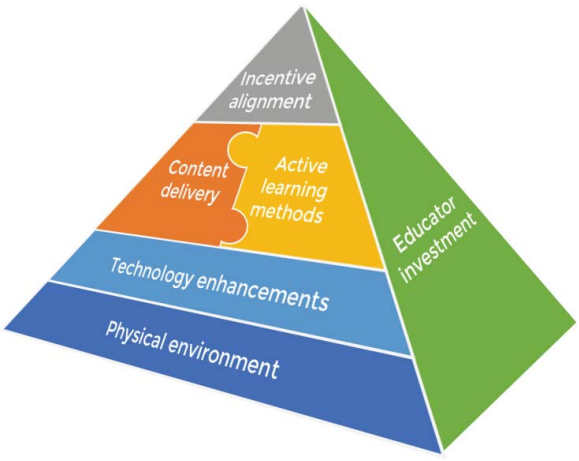

Figure 1. CAPTIvatE elements and relationships.

Decisions regarding these two elements will both influence and be influenced by other elements. The physical environment is the foundation for the design of the course, and the primary resource and constraint in planning content delivery, active learning, and implementation of in-class technology enhancements (Brooks, 2011). Typically the physical environment is a given, so instructors must consider how to use other elements to make the best use of the assigned space for the benefits to student learning. Technology enhancements are tools for supporting content delivery, active learning methods, and incentive alignment (Heide & Henderson, 2001). Creative use of technology can act as a bridge or interface between the physical environment and activities or content delivery (Barak, Lipson, & Lerman, 2006). Incentive alignment brings all other elements together to incentivize students to learn and hold them accountable for their preparation (Docan, 2006; Mader, 2009). Without proper incentives, active learning methods may fall flat, making efforts in other areas potentially ineffective. Finally, educator investment underlies all aspects of the course and student learning. Educator investment is essential in determining how the other elements will fit together, making them come to fruition, and delivering the course with confidence to inspire investment by the students (Brownell & Tanner, 2012). In the following section, we describe each element in more detail, discussing the interactions among them and providing suggestions as to the considerations important for each.

Content delivery

All courses require some form of enabling knowledge transfer. In a successful active learning implementation, consideration must be given to how course content is to be delivered to students. Traditionally, this is accomplished through lectures, slides, or assigned readings. Some didactic delivery of content is usually necessary, but choosing the best vehicle for delivery is key.

There are several considerations important in determining how to manage content delivery. First is the determination of what portion of the content may be delivered interactively, and what portion should remain didactic. This should take into account the level of student knowledge, the context of the course, and the topics being delivered. Second, consideration should be given to how much class time should be devoted to passive content delivery versus interactivity. This decision may be based on the relative importance or complexity of the

Table 1. CAPTIvatE elements, considerations, and examples.

Element	Items to consider (interactions with other elements in parentheses)	Examples
C Content delivery	• What portion of content can be delivered actively, and what portion should remain didactic? (A) • How much class time should be dedicated to passive content delivery? • What method of delivery should be used (lecture, readings, multimedia, activity, etc.)? (A, T)	• For courses based on judgment, a large portion of the content may be delivered interactively. • For courses requiring more didactic delivery, a flipped classroom approach might be used in which students watch recorded lectures before class, to free time for active learning reinforcement during class time.
A Active learning methods	• To what extent will activities be used for primary content delivery or for reinforcement? (C) • What active learning methods to implement? Existing methodology? Ad-hoc? (C) • How much class time should be used for activities? (C) • Will students perform activities individually or in teams? Will teams be static or dynamic? (I)	• "Team-based learning" methods could be used to provide a structure for implementing active learning, and includes some mechanisms for incentive alignment. • If content can be delivered actively, more time can be dedicated to active learning. Otherwise, careful attention must be paid to the balance between content delivery and activities during class time.
P Physical environment	• What features and limitations of the classroom will impact possibilities for active learning activities? Content delivery? (C, A) • How might the classroom space be used in creative or nontraditional ways to support activities? (A, T) • Are there alternative spaces available for use during specific activities? (A, T) • If in a space designed for active learning, how is the ability to lecture, etc. impacted? (C, A, T)	• In a traditional classroom setting, furniture might be moved to create active spaces. • With fixed furniture, reduce team sizes, or design activities around the existing spaces. • Study rooms, conference rooms, or outdoor areas can make for good spaces for breakouts. • In a classroom designed specifically for active learning, traditional activities such as lecturing may need to be modified to work in the space.
T Technology enhancements	• How might technology available in the classroom be used to enhance the active learning experience? (A, P) • What technologies might improve content delivery, communication, coordination, material reinforcement, evaluation, or activities outside of class time? (C, A, I)	• Available technology provides near limitless opportunity. Examples include team workstations, poll and response, screen sharing, course management, multimedia delivery, electronic assessment, etc.
Ivat Incentive alignment	• How can students be motivated to prepare outside materials (read, watch video lectures, etc.) if content delivery is shifted outside of class time? (C, A, T) • What incentives might encourage engagement and prevent freeloading? Overzealousness? (A, T)	• Beyond traditional methods such as high-stakes exams, quizzes, and graded assignments, active learning allows for additional incentives, such as class competitions, inherent enjoyment of activities, sense of responsibility and accountability to teammates, etc.
E Educator investment (supports all other elements)	• How can attitudes toward active learning be promoted? • What areas of skepticism or apprehension should be addressed, and how? • How much time should be set aside in the precourse preparation stages for incorporating active learning into a course? • How will daily preparation be impacted as the course is executed? • How might incentives be created to motivate instructors to invest in creating active learning courses? • What resources can be made available to assist instructors? • Are there others interested in active learning with whom to create a support network?	• To address attitudes and skepticism, seminars regarding active learning methods and outcomes, discussions with those using active learning, student and educator testimonials, etc. • For course preparation, as an example, if using flipped classroom techniques, lectures can be prepared and recorded in advance of the beginning of the course, increasing precourse preparation time, but decreasing mid-course preparation time before each class meeting. • Institutions might support active learning by including instructional innovation and course development goals in performance evaluation, providing relief or compensation for course development, or teaching funds for investment in active learning materials or technology.

content. Finally, a delivery method should be chosen to take advantage of instructor and student time. If high quality and relevant written materials exist or can be created, it may be sufficient to require students to prepare via readings before coming to class to engage in activities. If written materials are not effective at conveying the content, some form of multimedia may be required for out-of-class preparation.

Flipped classrooms

With the development of technology, a recent approach for content delivery rooted in active learning is the flipped classroom. Students use written or multimedia resources to perform traditional in-class activities, such as viewing lectures, before class. Class time is used to provide practice, guidance, and feedback in problem solving (Demetry, 2010, Asef-Vaziri, 2015). Bishop and Verleger (2013) provide a theoretical framework to support flipped classrooms. The core concept is that the time that students have with the instructor is too valuable to use for only didactic delivery of materials, but should be spent with the instructor guiding and directing students in what traditionally was considered homework. For these reasons, the flipped classroom approach could be one considered for content delivery consistent with the CAPTIvatE scheme.

Active learning methods

Active learning methods are described as those that are student-centered, maximize interaction and participation, and encourage students to move beyond superficial and fact-based approaches to course materials (e.g.,

Bonwell, 1991; McCarthy & Anderson, 2000; McKeachie, 1987), and are becoming more common in higher education (Michael, 2006; Prince, 2004). Instructors who adapt their teaching practices to provide more active learning experiences take on the roles of facilitator, coach, and mentor, while students learn that it is their role to discover, construct, create, and understand knowledge rather than relying on memorization and rote recall (Prensky, 2001). Students learn what they care about and remember what they understand (Ericksen, 1984), so engaging students in active learning helps them to invest in their own learning. This engagement in meaningful learning activities includes time for reinforcement and reflection, and leads to better student attitudes and improvements in students' thinking and writing (Bonwell, 1991).

In an active learning classroom, students have the opportunity, or often the requirement, to discuss, experiment, test ideas, and explore options. Active and cooperative learning improves students' attitudes toward the subject area, improves relationships between students, and improves knowledge retention (D. W. Johnson & Johnson, 1981). Additionally, there is evidence that active learning has a positive impact on student retention, and that student involvement is one of the most important predictors of success in college (Astin, 1993). In addition to its academic advantages, active learning has been shown to produce numerous social and psychological benefits (Faust & Paulson, 1998). Michael (2006) wrote a complete review of many resources associated with evidence on the effectiveness of active learning methods.

Active learning is more than just application-based learning. It must provide students with the opportunities to reflect, evaluate, analyze, synthesize, and communicate on or about information (Fink, 2013). Students spend time in class thinking, reading, writing, discussing, and doing to better understand and learn the material of the course.

Some considerations for planning for active learning include the careful design of activities, how they will be structured, how they will fit into class time, what materials instructors will introduce or reinforce, and how students will be organized. A primary concern is student investment. While students in active learning courses report that they are more engaged and that they learn and retain more, students may report that there is more work involved in active learning. Even though it is "good for them," they may resent it and be more prone to complain about the intellectual effort needed to learn (Smith & Cardaciotto, 2011). Managing student attitudes and expectations toward the active learning format can be a key factor for success. Successfully managing student expectations toward the process is shown to influence their satisfaction (Reinig, Horowitz, & Whittenburg, 2011).

Team-based learning

One method for implementation of the active learning philosophy is using team-based learning. The concept of team-based learning originated in the business school with Larry Michaelsen at the University of Oklahoma (Michaelsen, Knight, & Fink, 2002). Team-based learning utilizes carefully constructed and consistent teams, thus holding students accountable for their preparation before attending class, and spending the bulk of class time on application-based, hands-on learning activities in which students receive frequent and immediate instructor input and feedback (Michaelsen, 2002). Team-based learning involves more than including a group project or a team presentation; it encourages positive interdependence and individual accountability (Cooper, 1990). Students are held accountable for preparation before class, demonstrate their readiness both individually and as a team, receive immediate feedback, and then spend the rest of the time in class applying the foundational knowledge in team activities (Michaelsen & Sweet, 2008). The true power of the team is derived from the cohesiveness that is developed through the team-based learning activities (Michaelsen, 2002). Team-based learning has been implemented in a wide range of business and nonbusiness courses and nonacademic settings (Haidet, Kubitz, & McCormack, 2014; Michaelsen, Knight, & Fink, 2002). For these reasons, team-based learning can be considered as one option for an active learning method that aligns with the CAPTIvatE scheme.

Physical environment

The use of physical space is an important component of any active learning course. In traditional courses, the only requirement for the physical environment is that it allows students to see, hear, and understand the instructor as he or she delivers course content. In an active learning course, students must still be able to understand the instructor in any directed communication, but in addition, students and instructors must be free to interact with one another in course activities. One approach to address these challenges has been to design a classroom specifically to support active learning (Brooks, 2011). A pilot study at the University of Minnesota (ALC Pilot Evaluation Team, 2008) found overall positive reactions to the active learning classroom from students and faculty. The study specifically found a reduction in perceived psychological distance between instructor and students and among students. A similar

study conducted by North Carolina State University (Beichner, Dori, & Belcher, 2006) provides a consistent result and further concludes that the active learning classroom can also work for courses with high enrollment, with considerations for how to use the space to best support active learning.

However, many instructors do not have the luxury of designing a special classroom space for active learning. While beneficial, this type of space is not necessary for implementing active learning methods. With careful planning, any space can be used. Whether using an existing classroom or a classroom created with active learning in mind, how the physical space is utilized will have an impact on the design and effectiveness of active learning methods. For instance, if the course is to be held in a traditional classroom with long, rectangular tables and fixed chairs, team sizes may need to be adjusted down, as it may be difficult for a large number of students to gather around a single document or workstation. For those who are able to influence the design of space, it should be expected that the work surfaces chosen will influence the natural size of teams. Careful planning regarding the use of space and furniture within the space will have a large impact on how students perceive the course activities—ensuring that the space and activities complement one another will remove distractions and increase effectiveness of the course.

Technology enhancements

Technology can support effective learning and knowledge integration, which can foster knowledge and concept representations that cater to a variety of learning styles (Jonassen, Davidson, Collins, Campbell, & Haag, 1995). Considerations for technology use include those for both in- and out-of-class use. In class, sufficient technology should be available to support student activities. This may include computer workstations, presentation equipment, and student response systems. The decisions for what technology to use in class should follow directly from the active learning methods used and in-class activities planned, and should be designed to enhance and make the most out of these activities. Out-of-class technologies, correspondingly, should be selected to support content delivery and extension activities. These technologies might include platforms for delivery of video lectures or other course materials, or tools for continuation of the classroom discussions and activities. If any team-based activities are planned for outside of class time, team coordination software such as discussion boards, synchronous or asynchronous meeting tools, or collaborative content repositories may be considered. The role of technology is to support students and instructors in the course, reducing frictions that may otherwise decrease effectiveness of learning. Careful consideration these issues related to technology is an important element within the CAPTIvatE scheme.

Incentive alignment

If students were strictly motivated by the opportunity to learn, the elements within the CAPTIvatE scheme as presented previously might alone be sufficient. In reality, instructors must manage and align student incentives to hold students accountable and provide the best opportunity to learn (Boud & Falchikov, 2007). Incentives to consider may be categorized into those that will accomplish two objectives: accountability for preparing material and performing activities outside of class, and engagement in active learning. The techniques best suited to impact these incentives will be related to other decisions made regarding the class structure. For instance, if course content is delivered using recorded lecture videos in a flipped classroom style, a quiz may be implemented in class to determine if the students prepared by viewing the lectures. On the other hand, if students were to answer questions related to a case and be ready to discuss them in team activities, the instructor might collect and grade the answers. Activities should be designed to encourage active participation and engagement. In any team activity, freeloading and, conversely, overzealousness may be concerns. Team composition, effectively designed team evaluations, assignment and potential rotation of roles, and individual assessments after team activities are techniques that may be considered to alleviate concerns. The team-based learning literature includes guidance for many of these issues (Michaelsen & Sweet, 2008, 2011).

Educator investment

Underlying all other elements of a successful active learning course is educator investment (Brownell & Tanner, 2012). Implementing active learning methodologies and the elements outlined above requires a considerable mental shift from traditional teaching methods, as well as time committed to planning the course. Educator investment, therefore, is a key factor, and comprises the following three equally important aspects: attitude, preparation, and support.

Attitude

Instructors who have successfully implemented active learning methods have significantly different attitudes toward learning than their more traditional counterparts (Pundak, Herscovitz, Shaham, & Wiser-Biton,

2009). These instructors are more confident of students' abilities to learn independently, are more focused on student understanding rather than on addressing a specific quantity of material, and view their roles of identifying learning difficulties and developing appropriate teaching methods as more important than that of merely transmitting knowledge. These attitudes are critical to the success of active learning (Pundak & Rozner, 2008). To adopt this line of thought, instructors must overcome apprehensions related to active learning (Brownell & Tanner, 2012). These commonly include concerns about the amount of work involved to offer an active learning course, discomfort in giving up the traditional pedagogical role and seemingly the control of the classroom, and concerns about the willingness and capacity of students to contribute actively (Niemi, 2002). Instructors should evaluate their attitudes toward active learning before designing their course and identify areas of skepticism or apprehension to be addressed before moving forward.

Preparation

A primary concern related to implementing active learning methods relates to the time and effort required. While it is undeniable that an investment of time and effort is required to create or redesign any course, those with experience disagree that active learning courses necessarily require more effort than those taught in a traditional manner (Scheyvens, Griffin, Jocoy, Liu, & Bradford, 2008). Also, based on the evidence we discuss and provide in this article, the improvements in student outcomes merits a certain level of effort. Specifically in active learning courses, a heavier initial investment in the preparation of the course may be required. Considering the activities for engaging students as well as the other elements we outline requires planning before the course, more so than in a traditional course. However, with active learning, more of the course content and delivery may be spontaneous, requiring possibly lower effort during execution. In addition, instructors may choose to implement active learning incrementally, continuously improving rather than completely re-engineering their course, which may alleviate some concerns. Regardless, instructors who wish to successfully implement active learning methods in their courses should plan to invest time in their course preparation in consideration of each element of our scheme.

Support

Support from the institution and from fellow teachers is important when implementing an active learning course. From the institution's perspective, this begins with encouraging innovation and adoption of effective teaching methods rather than promotion of the status quo. Incentives matter in teaching, just as in any other pursuit (Figlio & Kenny, 2007), so institutions that incentivize the use of innovative methods in teaching should see more investment from instructors. Incentives would not have to be monetary. They could be motivational (creating faculty discussion groups or peer mentoring), inspirational (highlighting faculty who are using active teaching methods), or provided by communicating expectations (annual reviews, promoting the institution's mission). An effective incentive structure for instructors should ensure that curriculum or other teaching constraints do not discourage the use of active learning methods. Flexibility in arrangement of learning objectives among courses, requirements for assessing student performance, and limits or quotas on contact time or allocation between "lecture" and "lab" can help eliminate barriers to effective active learning implementations.

Additionally, institutions can encourage active learning methods by providing resources for instructors. The resources may range from the availability of physical classroom environments conducive to collaborative work, to funding for software for providing content or managing courses, to training in active learning methods. Instructors should also seek out support from fellow teachers or communities dedicated to active learning methods. Sharing experiences, issues, ideas, and resources with others reduces the burden of trying to figure everything out in isolation. This type of support also may help with attitude shifts by exposing the educator to others who are enthusiastic about and experienced with active learning methods.

Implementation

For the remainder of the article, we provide example implementations of this scheme carried out by us in three distinct courses. We provide the details of a specific active learning space used by two of the courses as well as the aspects of educator investment shared by the three instructors, then go on to describe the remaining elements of the scheme in each course. Finally, we provide evidence of the courses' effectiveness in improving student learning.

Physical space

A project led by one of the authors (Tawnya Means) at a large, public, research-intensive university's college of business was recently undertaken to transform a traditional classroom space into an active learning space. The Active Learning Studio classroom was envisioned and designed as a technology-enhanced learning space to

support alternative methods of delivery of instruction as well as team-based learning and other active learning strategies. Instructors teaching in the redesigned classroom are encouraged to explore and investigate alternative teaching strategies beyond traditional lecture. The room was renovated from a row-by-row, forward-facing, instructor-directed classroom to a room with round tables for team-based, student-focused learning experiences (see Figure 2).

The classroom furnishings now consist of four round tables, each with four chairs and a team computer on each half of the table, for a total of eight team stations and 32 seats. The team monitors have the ability to accept input from laptops or other devices such as iPads or tablets. There are extensive whiteboards around the room to allow the instructor and students to talk through, brainstorm, demonstrate, and discuss ideas. The east and west walls of the classroom each have projection screens that allow the instructor display or any of the team displays to be projected for presentation or discussion. The technology in the room allows the instructor to direct students to work on application-based learning activities in the classroom while providing direction, feedback, and encouragement to students as they learn. The instructor console is located in the middle of the room to encourage the instructor to move freely around the room and interact with the students working in teams at their tables.

During team-based learning activities, the instructor moves around the room and observes the students as they are working, allowing for immediate feedback to be provided as needed. The room provides enough space for teams to focus their attention on working together to analyze problems, develop solutions, and participate in team discussions. Additionally, the technology in the room (such as four cameras, audio and video switching hardware and software, software for web conferencing, and webcams on team computers) supports both in-room and remote students to participate in team-based activities. The room is currently used in the college by instructors teaching a variety of business courses, including ethics, information systems, operations management,

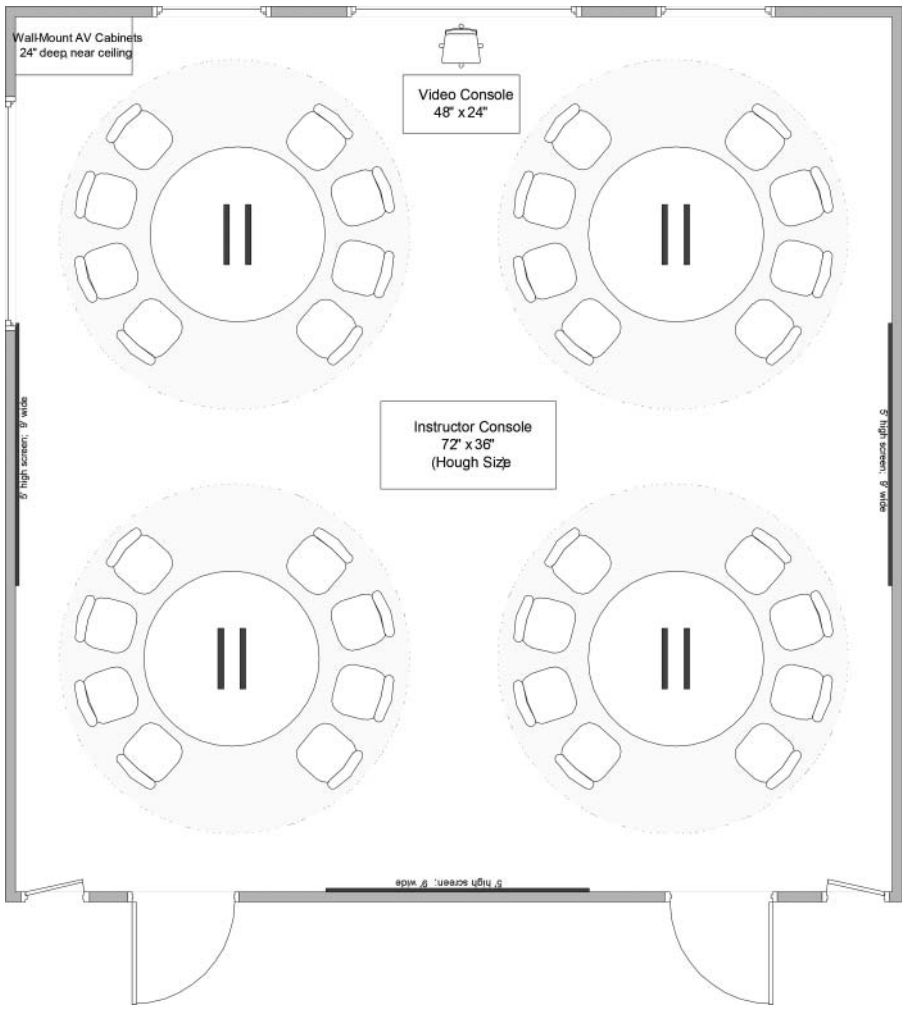

Figure 2. Active learning studio classroom layout.

strategic management, financial cases, international retail marketing, and more. The room is also being used by other groups and organizations in the university to deliver sessions for local and remote participants.

Educator investment

Before the instructors' implementation of active learning strategies in their teaching, one of the authors (Tawnya Means) championed a support structure within the college for educator investment in active learning. Instructors with potential interest in implementing active learning in their courses were recruited to join a forum for exchanging ideas and mutual encouragement in designing these courses. Workshops were organized, with invited guests from other universities and other colleges within the university presenting insights and ideas gathered from their own experiences with active learning. The forum and workshops provided helpful materials for preparation of the courses, as well as help in developing enthusiasm toward active learning. The forum received support from the institution as well, which provided funds for materials and technology to be used in the courses. Each educator initially invested heavily in the preparation for the courses, but gained efficiencies during course delivery as more responsibilities for preparation and content assimilation were transferred to students.

The remainder of this section addresses three specific courses using the CAPTIvatE active learning scheme we propose, including their incorporation of the content delivery, active learning methods, physical environment, technology enhancements, and incentive alignment elements. Table 2 provides details for each course and Table 3 outlines the implementations relative to each key element.

Course 1: Business systems

The course in business systems is available to junior and senior undergraduate students in the information systems major, and may also be taken as an elective by other business or nonbusiness students. The primary objectives of the course are to teach students the concepts of object-oriented programming and prepare them for future careers that will benefit from awareness and knowledge of these concepts. Active learning techniques and use of the Active Learning Studio classroom are ideal, as the subject matter relies on the application of concepts, rather than the conveyance of facts. The techniques used directly address key challenges presented in such a course. For instance, most of the enrolled students have little experience with programming and require significant assistance, which is provided by maximizing opportunities for interaction with fellow students and the instructor.

A team-based learning approach was used for this course, maximizing the opportunity for students to learn the course material through interaction with each other and the instructor. Students were assigned to teams at the beginning of the course, and remained in these teams throughout the semester. Teams were carefully chosen by the instructor so as to distribute prior skills and knowledge, making the most of inherent student diversity to incentivize students to teach and learn from each other (Koppenhaver & Shrader, 2003). This was performed using results of a knowledge survey which students completed before the start of the course—see the Appendix for a list of questions asked in this survey.

To have sufficient time in class for team-based learning activities, the content of the course was delivered using a flipped classroom approach. Students were required to view video lectures on YouTube recorded by the instructor and read corresponding textbook chapters before class. The flipped classroom method provided a key foundation for this course, as it shifted necessary didactic elements of the course out of the classroom for the student to absorb on his or her own time, allowing the full use of class time for more interactive and experiential activities. To create incentives for adequate preparation, students completed a readiness assessment quiz at the beginning of each class. The assessment was intentionally brief (typically five multiple-choice questions), and students first completed the assessment individually. After students submitted their individual answer sheets, they completed the same assessment again, but this time as a team using a scratch-off card, which is prepopulated with the correct answers. Teams were encouraged to discuss amongst themselves and come to a consensus before choosing an answer. Differing opinions were discussed until the team reached a

Table 2. Course, semester, teaching method, and classroom type.

Course	Course Description	Enrollment	Semester offered	Teaching method	Classroom type
1: Business Systems	Object-oriented programming	28	Fall 2012	Team-based Learning	Active Learning Studio
		29	Spring 2013		
2a: Operations Management	Excel-related operations models	30	Fall 2011	Lecture	Traditional
2b: Operations Management	Excel-related operations models	31	Fall 2012	Active Learning	Active Learning Studio
3a: Business Telecom Strategy	Telecommunication and networks	38	Fall 2011	Active Learning	Traditional
		38	Spring 2012		
3b: Business Telecom Strategy	Telecommunication and networks	55	Fall 2012	Team-based Learning	Traditional
		46	Spring 2013		

Table 3. Overview of active learning implementation.

Course	Active learning methods	Content delivery	Physical environment	Technology enhancement	Incentive alignment	Educator investment
Business systems	• Team-based learning • Majority of class time is allocated to team activities • Real-time feedback on programming assignments	• Flipped classroom using YouTube videos • Students prepare before class • Short demonstration of concepts learned from videos at start of class	• Taught in the Active Learning Studio	• Team workstations • Instructor can share screens • YouTube lecture videos • Online survey for team allocation • Plagiarism detection software • Online course management system	• Two in-class exams • Individual coding project • Individual and team readiness assessment tests • Roles are assigned and rotated during team activities	• Attended workshop focusing on Active Learning • Record and upload the lectures online before semester • Technology and support resources provided
Operations management	• Team-based learning • Real-time feedback • In-class exercise competition	• In class lectures • Students prepare before class • Students follow demonstrations by the instructor	• First taught in traditional classroom, then taught in the Active Learning Studio	• Team workstations • Instructor can share screens • Projection • Online course management system	• Two in-class exams • A team-based project • Team-based class competition	• Attend workshop focusing on Active Learning • Prepare team-based exercise
Business telecommunication strategy	• Team-based learning • Majority of class time is allocated to team assignment • Real-time feedback	• Students prepare before class with readings • Some lecture in class	• Taught in a traditional classroom with rows of tables and chairs	• Student laptops plug into the instructor port for screen sharing • Projection • Online course management system • Twitter feed • Online survey • Discussion forums	• One in-class exam • Individual and team readiness assessment tests • Peer evaluation • Participation points	• Attend workshops focusing on Active Learning • Assist other instructors implementing active learning • Prepare readiness assessment

decision. Along with the immediate feedback through the scratch-off assessment form, this allowed team members to learn through communicating their ideas to others and clear up individual misconceptions. A brief time was allocated to discussing any student questions, but was usually unnecessary because of the team discussions that took place while filling out the scratch-off cards.

Following the readiness assessment, the instructor performed a short demonstration presenting an application of concepts the students prepared. The remainder (and majority) of class time was then allocated for students to participate in activities that reinforced the concepts they had learned. These activities generally consisted of team programming assignments. Requiring students to perform these assignments in class and in teams allowed the assignments to be more complex and richer than those which might be assigned for individual completion on a student's own time. Students were able to focus on the concepts that they were learning rather than struggling with syntax or other minutia, and the instructor was available to assist students with issues as they were encountered. Real-time feedback allowed students to recall more of their thoughts in performing the assignment and gain more from the feedback provided. To ensure full participation by each team member during in-class activities, roles were assigned and rotated among team members each class period. The "leader" drove the project, the "coder" was the only individual allowed to write the program, and "interpreters" were responsible for explaining what was done when the instructor graded the assignment at the end of class. In addition to motivations which exist in any class, including obtaining a positive grade and wanting to learn, students were accountable to their teammates in every class period and every activity. This made students work harder so that they did not adversely affect other team members' grades as well as motivated them to share knowledge and insights with team members. In addition to the readiness assessments and team assignments, the course had two individual in-class exams and an individual coding project completed by the students outside of class time. These traditional instruments provided additional individual incentives for students to learn the material.

Technology enhancements in the Active Learning Studio classroom were used to improve the effectiveness of team activities. The team workstations in the classroom were an important component for this course, as they allowed students to work on team assignments without huddling around a possibly small, and potentially unreliable student laptop. As the workstations are all connected to each other and the central workstation, it was very easy to display any workstation to the entire class. This was very useful during programming assignments to allow the instructor to share work from a team which had encountered a common pitfall or mistake, or had done something particularly well.

Course 2: Operations management

The operations management course is available to junior and senior undergraduate students in the business school. This fundamental operations analysis course covers the topics of project management, time series forecasting, queuing theory, and decision analysis. The objective of the course is to introduce concepts and applications of decision sciences. The focus is on model building and implementation using Microsoft Excel.

The course was first taught by this instructor in a traditional classroom using a primarily lecture-focused approach in the fall of 2011. In the traditional lecture-based class, students were expected to absorb the knowledge transmitted through lecture by the instructor. The instructor found that it was difficult for students to understand the logic as well as follow the software implementation due to the configuration of the classroom and technology capability.

In the fall of 2012, the course was moved into the Active Learning Studio classroom and a more active learning method was implemented to increase student engagement in the course. This included many of the same teaching strategies as in the business systems course described previously. The Active Learning Studio classroom and active learning techniques provided students and the instructor with a superior experience that included enhanced student to student and student to instructor interaction and engagement.

As the majority of the course was quantitative in nature, content was still delivered via a traditional lecture format, but students were more easily able to raise questions freely during the lecture due to a better connection with the instructor. The flexible space in the Active Learning Studio allowed students to collaborate in teams using the team workstations. This contrasted with the traditional classroom space from the first semester and the instructor observed that it was a more ideal environment for learning and motivated students to stay focused and concentrate during the class period. The students used the technology in the Active Learning studio, including Excel at the team workstations. They performed research online to participate in a competition exercise. Competition among project teams has been shown is a helpful method to promote students' performance in the business environment (Özpolat, Chen, Hales, Yu, & Yalcin, 2014). Rather than relying on readiness assessment to hold students accountable, a weekly team-based exercise competition was scheduled at the end of each topic, focusing on real-world applications of

the tools covered. For instance, the competition exercise at the end of the forecasting chapter asked students to use time series forecasting techniques to make their best prediction of the future price of ground roast coffee from data provided by the U.S. Department of Labor. Each team explored different forecasting techniques and deliberated within their team to determine which model provided the best result. For each competition, each member of the first two teams who submitted the most accurate answer were rewarded bonus points toward their final grade, although the most accurate solutions were not announced until after all teams submitted to avoid discouraging later submissions. During the competition, teams were encouraged to engage with the instructor and each other to arrive at the best solution. The competition supported students in active learning and provided for incentive alignment.

Course 3: Business telecommunication strategy

The business telecommunication strategy course is available to junior and senior undergraduates in the information systems major as well as first year graduate students in the information systems and operations management master's program. The objective of the course is to provide students with an introduction and overview of telecommunications, business applications, and strategy. The goal is for students to come out of the course with a familiarity of elements of networking and associated terminology as well as to encourage them to think critically about technological solutions for business. In the first two semesters the course was offered, the instructor used a mix of lecture and significant active learning opportunities, including discussion activities, team presentations, and simulations. However, students struggled with the amount of content covered in the course. In the second two semesters, the instructor adjusted the active learning methods to use team-based learning.

Students were placed in carefully composed permanent teams. According to the team-based learning literature (Michaelsen, 2002), the optimal team size is relatively large (five to seven members). In a traditional classroom setting, teams of this size may have difficulty collaborating, but reducing the number of team members may limit the diversity in perspectives that students experience during team activities. Also, if teams are smaller, the amount of time the instructor is able to spend with each team may be decreased. Considering these elements, team sizes were kept large at around seven members, but students were further divided for activities that required close collaboration (e.g., the use of a shared computer). This allowed teams to retain a high level of diversity and participation, while still effectively utilizing the physical environment.

Students were expected to prepare before class attendance, including textbook readings and other materials delivered online. This provided the bulk of class time for application-based learning activities. Students were held accountable through readiness assurance testing at the beginning of each class session. They also completed an individual exam and a written report to hold them accountable for their individual learning in the course. The team application activities included creating a team presentation as a consulting firm advising a company for expansion.

The number of students enrolled in the course was too high for placement in the Active Learning Studio, so the class was held in a traditional classroom with rows of fixed tables and chairs. One concern with the physical layout of the room was the difficulty that the instructor had in moving between teams, providing advice or performing grading activities. In this course, the instructor frequently encouraged teams to move away from the tables and to group their chairs together for discussions and other collaborative activities, which were designed to be performed without a table surface. This made it easier for the instructor to access and interact with the teams.

The traditional classroom included no in room technology other than the instructor computer and projectors. However, students used their personal laptops and other devices. The course management system, Twitter, and a discussion forum were used to enhance student engagement.

For completion of many of the activities assigned in the course, teams required the ability to share information from their workstations. To share information, students plugged their laptop into the instructor port at the lectern or used the instructor computer connected to the main projectors. This required coordination and time, but was a reasonable solution for the need to display shared content given physical environment and technology constraints.

Preliminary assessment of effectiveness

The effectiveness of the CAPTIvatE scheme as implemented in these courses was assessed through course evaluations, student grades, and student surveys. Course evaluations as a measurement for teaching effectiveness have been widely adopted in the pedagogy literature (Buckley, 2003). However, there are some limitations associated with using course evaluations. For example, students may provide more favorable ratings when they are informed that the results would be used for administrative decisions (Aleamoni & Hexner, 1980). Additionally, there can be issues with response rates. To accurately estimate the net effect of the CAPTIvatE scheme, we have controlled for various elements that may influence the evaluation results, which we will discuss in detail below. We also incorporated the results from the course grade of

Course 2 and student surveys to complement the assessment of effectiveness. The use of surveys has been acknowledged as a common and established measurement in the education literature. Scholars have used the results from surveys to measure the outcomes of a variety of different pedagogical innovations (e.g., Adya, Temple, & Hepburn, 2015; Bhowmick, Chandra, Harper, & Sweetin, 2015; Özpolat et al., 2014).

Course evaluations and grades

Course evaluation data from two of the above described courses provide a means for assessing the effectiveness of the active learning scheme (Course 1 was taught for the first time in the Active Learning Studio, and therefore had no basis for comparison). Based on these evaluations, it is easy to see that students respond enthusiastically to the active learning environment enabled by our scheme. Tables 4 and 5 display the summary of course evaluations from two of the courses both before and after implementing the active learning scheme. Course 2a was taught using a lecture-based approach in a traditional classroom, whereas Course 2b implemented team-based learning and the active learning scheme in the Active Learning Studio. Course 3a was taught using some active learning methods, but without consideration of all the elements, whereas Course 3b fully implemented team-based learning with the active learning scheme, with both using a traditional space. The results are striking, with all measures of amount learned and value of the course increasing under the active learning scheme, while the amount of effort in the course, and ratings for other courses in the college remaining constant. To accurately estimate the net effect of the active learning scheme, we control confounding elements that might influence the evaluation results. Courses 2a and 2b were each taught by the same instructor, using consistent course materials including syllabus, slides, assignments and exams. The only changes were to implement team-based learning and other active learning strategies. Similarly, Courses 3a and 3b were taught by the same instructor using similar materials each time. The students in the courses had similar background knowledge, and there was similar enrollment in the classes.

Table 4. Summary of course evaluations and grades in Course 2.

Question	Before active learning strategy (27 of 30 responded)	After active learning strategy (29 of 31 responded)	*p* value
Overall rating of the course	4.59	4.83	.0530†
College mean	4.19	4.16	—
Communication of ideas	4.37	4.62	.1757
Facilitation of learning	4.48	4.62	.4138
Amount learned	4.19	4.48	.0822†
Amount of effort required	3.63	3.59	.8459
Educational value of this course	4.30	4.59	.1287
Average of students' overall grade	88.59	91.10	.0832†

†$p < .10$.

Table 5. Summary of course evaluations in Course 3.

Question	Before active learning strategy (43 of 76 responded)	After active learning strategy (58 of 101 responded)	*p* value
Overall rating of the course	4.00	4.60	.0001**
College mean	4.19	4.24	—
Communication of ideas	3.93	4.43	.0024**
Facilitation of learning	3.74	4.38	.0007**
Amount learned	3.35	3.97	.0024**
Amount of effort required	4.30	4.39	.5732
Educational value of this course	3.65	4.14	.0115**

Note. ***, **, * = statistically significant at the 1%, 5% and 10% levels (two-sided test), respectively.

The public course evaluation results use a 5-point Likert-type scale ranging from 1 (*poor*) to 5 (*excellent*). During this period, Course 2 evaluations significantly improved from 4.59 in fall 2011 to 4.83 in fall 2012 ($p = .0530$), a significant difference considering the relatively small sample sizes. In the meantime, the overall evaluation in the college slightly decreased from 4.19 to 4.16. Similarly, the rating of Course 3 increased from 4.00 to 4.60 ($p = .0001$) between the terms taught using a mix of traditional and active learning strategies to those using a full team-based learning approach. Evidence indicating that implementation of the active learning strategy in this course helped students study more effectively may be seen in student ratings of the amount learned and the amount of effort required for the course. Students reported that they learned more (Course 2, $p = .0822$; Course 3, $p = .0024$) without spending more effort while in the active learning environment. Apart from students' perceived improvement, we also find that students' overall grades also improved in Course 2 from 88.59 to 91.10 ($p = .084$).[2]

Student surveys

To better understand students' opinion of the active learning environment compared with a traditional course, students were asked to complete an online survey.[3] The survey contained 12 questions related to students'

experience in the traditional or active learning environments and was delivered before and after students experienced a course in the Active Learning Studio classroom, creating an independently pooled cross-section of responses. A total of 167 students responded to this survey before they participated in a course in the Active Learning Studio classroom. These students answered survey questions based on their experiences with traditional courses. Within the same population, 64 students completed the survey after taking at least one course in the Active Learning Studio classroom. After data-cleaning to remove incomplete responses, there were 156 and 61 data points on the traditional and active learning environments, respectively. The survey asked students to rank several aspects of their experiences on a 5-point Likert-type scale with responses ranging from 1 (*none*) to 5 (*a lot*). We selected the most relevant questions to the present study and the survey results are summarized in Table 6.

The survey validates many benefits of active learning from the students' perspective. One of the most salient features is the enhanced connection to the instructor as well as other students. The averages of students' connection to the instructor and to other students are only 1.90 and 1.83 from their traditional learning experience, respectively, compared with 3.18 and 3.15 in an active learning environment, both highly significant differences. According to Reyes, Brackett, Rivers, White, and Salovey (2012), connection in the classroom can have a major impact on students' success. Students tend to thrive in a learning environment in which instructors are sensitive to students' needs, develop deeper relationships with students, and consider students' perspectives.

It is also clear that students have more opportunities for peer collaboration and see its effectiveness and value in the active learning environment. This is in part due to the instructor's encouragement of engagement with classmates and the instructor in the active learning environment. The process of sharing knowledge with peers in collaboration not only improves the connection between team members but also solidifies the new knowledge in students' minds.

Finally, students' perception of the value of in class time has significantly increased, while there is no statistical difference between students' perception of the value of out-of-class time before and after experience in the active learning environment. Students' valuations of class time increased from 2.46 in a traditional lecture-based classroom to 3.15 in the active learning environment ($p < .0001$). This increase in value is likely due to the increased participation and responsibility students take for their learning during class time, when active learning techniques are employed. Regarding out-of-class time, in which students are performing more passive or didactic learning activities, the survey shows that students feel that they gain as much from these activities as they would from more traditional out-of-class activities such as homework or assignments. However, by transferring the didactic aspects of the course out-of-class, and moving more active aspects into class time, the value of this time is improved, while maintaining the value of out-of-class time, a net gain in overall value of the course.

Table 6. Summary of statistics from traditional and active learning classrooms.

	Traditional classroom	Active learning studio	*p* value from *t* test
Observations	156	61	
Connection to the instructor	1.90	3.18	.0000**
Connection to other students	1.83	3.15	.0000**
Experience with peer collaboration	2.35	2.89	.0004**
Effectiveness of peer collaboration for learning	2.29	2.54	.0552†
Value of participation in group work	2.56	2.89	.0212*
Value of the class time	2.46	3.15	.0000**
Value of the out-of-class time	2.67	2.59	.5950

†$p < .10$. *$p < .05$. **$p < .01$.

Conclusions and implications for instructors

In this article, we have presented active learning building blocks to guide instructors' efforts to more fully engage students in meaningful learning. The elements include content delivery, active learning methods, physical environment, technology enhancement, incentive alignment, and educator investment. Although there has been considerable research that indicates that active or cooperative teaching approaches with technology enhancements have benefits for student learning, many instructors still teach their courses using traditional lecture methods. This article contributes to the active learning literature by providing building blocks to guide faculty and ease concerns about turning more time over to student exploration. Courses that follow this scheme will still take time and effort in preparation, but the consideration of the elements in the scheme should reduce course design to a more surmountable task with significant benefits for students. Compared with those in traditional learning environments, students in courses implementing this innovative approach learn more while exerting the same amount of effort. They are more satisfied, earn higher grades, demonstrate greater understanding, and establish closer connections with fellow students as well as instructors. They report that they place a higher value on their experiences in the course. These outcomes seem well worth the effort required and place a clear impetus on instructors to consider the use of these techniques. With the use of these key

building blocks, we hope that more instructors will choose to implement active learning strategies into their courses, reaping the many benefits available.

We briefly note some limitations of this study and provide interesting directions for future research. To begin with, we did not formally test the interactions between the individual elements in the active learning strategy and educational outcomes. Future researchers should look into the correspondence among these connections, which will help instructors to better design and focus on the elements they would like to improve on. Further, we only have limited objective measures to assess the effectiveness of active learning and the elements in the CAPTIvatE scheme. Although course evaluations and students' surveys are the most common measurements in many pedagogical studies, both of them are imperfect due to individual subjectivity. Future researchers should adopt more rigorous and objective measures to investigate the effectiveness of the building blocks that we propose. Notwithstanding these limitations, we believe our research makes both practical and theoretical contributions to the literature on active learning. From the practical perspective, we provide instructors a list of elements to consider when implementing active learning. From the theoretical perspective, our research provides a conceptual foundation for future scholars to build on.

Notes

1. Some common active learning strategies include but are not limited to: interactive class discussion, problem solving, team-based learning, cooperative learning, course projects, peer teaching, and case studies. Interested readers in this topic can refer to Silberman (1996) who provides a more comprehensive list of strategies.
2. Grades for Course 3 were determined differently across semesters and are thus not comparable.
3. Due to the space limitation, we only summarized the result here. Interested readers are encouraged to contact authors for more details including detailed survey questions.

Acknowledgment

The authors are listed alphabetically and contributed equally to this work. We thank the review team at *Journal of Education for Business* for their valuable and constructive suggestions. The authors also thank conference participants of 2014 DSI Annual Conference for their helpful comments.

References

Adler, M. J. (1982). *The Paideia proposal: An educational manifesto*. New York, NY: Macmillan.

Adya, M., Temple, B. K., & Hepburn, D. M. (2015). Distant yet Near: Promoting interdisciplinary learning in significantly diverse teams through socially responsible projects. *Decision Sciences Journal of Innovative Education*, *13*, 121–149. doi:10.1111/dsji.12058.

ALC Pilot Evaluation Team. (2008). *Active learning classrooms pilot evaluation: Fall 2007 findings and recommendations*. Minneapolis, MN: Office of Classroom Management, University of Minnesota. Retrieved from https://classroom.umn.edu/sites/classroom.umn.edu/files/2017-09/alc_report_final.pdf

Aleamoni, L. M., & Hexner, P. Z. (1980). A review of the research on student evaluation and a report on the effect of different sets of instructions on student course and instructor evaluation. *Instructional Science*, *9*, 67–84. doi:10.1007/BF00118969.

Astin, A. W. (1993). *What matters in college? Four critical years revisited*. San Francisco, CA: Jossey-Bass.

Asef-Vaziri, A. (2015). The Flipped Classroom of Operations Management: A Not-For-Cost-Reduction Platform. *Decision Sciences Journal of Innovative Education, 13*(1), 71–89.

Barak, M., Lipson, A., & Lerman, S. (2006). Wireless laptops as means for promoting active learning in large lecture halls. *Journal of Research on Technology in Education*, *38*, 245–263.

Beichner, R., Dori, Y., & Belcher, J. (2006). New physics teaching and assessment: Laboratory- and technology-enhanced active learning. In J. J. Mintzes and W. H. Leonard (Eds.), *Handbook of college science teaching: Theory, research and practice* (pp. 97–106). Arlington, VA: NSTA Press.

Bhowmick, S., Chandra, A., Harper, J. S., & Sweetin, V. (2015). Collaborative learning using a project across multiple business courses: A cognitive load and knowledge convergence approach. *Decision Sciences Journal of Innovative Education*, *13*, 197–219. doi:10.1111/dsji.12060.

Bishop, J. L., & Verleger, M. A. (2013 June). *The flipped classroom: A survey of the research the flipped classroom: A survey of the research*. Paper presented at the ASEE National Conference, Atlanta, GA.

Bonwell, C. (1991). *Active learning: Creating excitement in the classroom* (Vol. 80819). Retrieved from http://www.ydae.purdue.edu/lct/hbcu/documents/Active_Learning_Creating_Excitement_in_the_Classroom.pdf

Boud, D., & Falchikov, N. (2007). *Rethinking assessment in higher education: Learning for the longer term*. London, UK: Routledge.

Brooks, D. C. (2011). Space matters: The impact of formal learning environments on student learning. *British Journal of Educational Technology*, *42*, 719–726. doi:10.1111/j.1467-8535.2010.01098.x.

Brownell, S. E., & Tanner, K. D. (2012). Barriers to faculty pedagogical change: Lack of training, time, incentives, and… Tensions with professional identity? *CBE Life Sciences Education*, *11*, 339–346. doi:10.1187/cbe.12-09-0163.

Buckley, K. M. (2003). Evaluation of classroom-based, web-enhanced, and web-based distance learning nutrition courses for undergraduate nursing. *The Journal of Nursing Education*, *42*, 367–370.

Chickering, A. W., & Gamson, Z. F. (1987, March). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, 3–7.

Cooper, J. (1990). Cooperative learning and college teaching: Tips from the trenches. *Teaching Professor*, *4*(5), 1–2.

Dale, E. (1969). *Audiovisual methods in teaching*. New York, NY: Dryden Press

Demetry, C. (2010). Work in progress – An innovation merging "classroom flip" and team-based learning. *Frontiers in Education Conference Proceedings*, T1E–1

Docan, T. N. (2006). Positive and negative incentives in the classroom: An analysis of grading systems and student motivation. *Journal of Scholarship of Teaching and Learning*, *6*(2), 21–40.

Ericksen, S. C. (1984). *The essence of good teaching*. San Francisco, CA: Jossey-Bass.

Faust, J. L., & Paulson, D. R. (1998). Active learning in the college classroom. *Excellence in College Teaching*, *9*(2), 3–24.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education*, *78*, 674–681.

Figlio, D. N., & Kenny, L. W. (2007). Individual teacher incentives and student performance. *Journal of Public Economics*, *91*, 901–914. doi:10.1016/j.jpubeco.2006.10.001.

Fink, L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses*. New York, NY: Wiley.

Hackathorn, J., Solomon, E. D., Blankmeyer, K. L., Tennial, R. E., & Garczynski, A. M. (2011). Learning by doing: An empirical study of active teaching techniques. *The Journal of Effective Teaching*, *11*, 40–54.

Haidet, P., Kubitz, K., & McCormack, W. T. (2014). Analysis of the team-based learning literature: TBL comes of age. *Journal on Excellence in College Teaching, 25*(3-4), 303.

Heide, A., & Henderson, D. (2001). *Active learning in the digital age classroom*. ERIC.

Johnson, D. W., & Johnson, R. T. (1981). Effects of cooperative and individualistic learning experiences on interethnic interaction. *Journal of Educational Psychology*, *73*, 444–449. doi:10.1037/0022-0663.73.3.444.

Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research*. Edina, MN: Interaction Book Company.

Johnson, P. A. (2011). Actively pursuing knowledge in the college classroom. *Journal of College Teaching & Learning*, *8*(6), 17–30. doi:10.19030/tlc.v8i6.4279.

Jonassen, D., Davidson, M., Collins, M., Campbell, J., & Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *American Journal of Distance Education*, *9*(2), 7–26. doi:10.1080/08923649509526885.

Koppenhaver, G. D., & Shrader, C. B. (2003). Structuring the classroom for performance: Cooperative learning with instructor-assigned teams*. *Decision Sciences Journal of Innovative Education*, *1*(1), 1–21. doi:10.1111/1540-5915.00002.

Mader, C. E. (2009). "I will never teach the old way again": Classroom management and external incentives. *Theory Into Practice*, *48*, 147–155. doi:10.1080/00405840902776483.

McCarthy, J. P., & Anderson, L. (2000). Active learning techniques versus traditional teaching styles: Two experiments from history and political science. *Innovative Higher Education*, *24*, 279–294. doi:10.1023/B:IHIE.0000047415.48495.05.

McGlynn, A. P. (2005). Teaching millennials, our newest cultural cohort. *Education Digest: Essential Readings Condensed for Quick Review*, *71*(4), 12–16.

McKeachie, W. J. (1987). *Teaching and learning in the college classroom. A review of the research literature (1986) and November 1987 supplement*. Ann Arbor, MI: Program on Curriculum, University of Michigan.

Michael, J. (2006). Where's the evidence that active learning works? *Advances in Physiology Education*, *30*, 159–167..

Michaelsen, L. K. (2002). Getting started with team learning. *Team learning: A transformative use of small groups*. Westport, CT: Greenwood.

Michaelsen, L. K., Knight, A. B., & Fink, L. D. (2002). *Team-based learning: A transformative use of small groups*. Westport, CT: Praeger.

Michaelsen, L. K., & Sweet, M. (2008). The essential elements of team-based learning. *New Directions for Teaching and Learning*, *2008*(116), 7–27. doi:10.1002/tl.330.

Michaelsen, L. K., & Sweet, M. (2011). Team-based learning. *New Directions for Teaching and Learning*, *2011*(128), 41–51. doi:10.1002/tl.467.

Niemi, H. (2002). Active learning—a cultural change needed in teacher education and schools. *Teaching and Teacher Education*, *18*, 763–780. doi:10.1016/S0742-051X(02)00042-2.

Özpolat, K., Chen, Y., Hales, D., Yu, D., & Yalcin, M. G. (2014). Using contests to provide business students project-based learning in humanitarian logistics: PSAid example. *Decision Sciences Journal of Innovative Education*, *12*, 269–285. doi:10.1111/dsji.12044.

Peck, A. C., Ali, R. S., Levine, M. E., & Matchock, R. L. (2006). Introductory psychology topics and student performance: Where's the challenge? *Teaching of Psychology*, *33*, 167–170. doi:10.1207/s15328023top3303_2.

Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, *9*(5), 1–6. doi:10.1108/10748120110424816.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, *93*, 223–231. doi:10.1002/j.2168-9830.2004.tb00809.x.

Pundak, D., Herscovitz, O., Shaham, M., & Wiser-Biton, R. (2009). Instructors' attitudes toward active learning. *Interdisciplinary Journal of E-Learning and Learning Objects*, *5*, 215–232. doi:10.28945/74.

Pundak, D., & Rozner, S. (2008). Empowering engineering college staff to adopt active learning methods. *Journal of Science Education and Technology*, *17*, 152–163. doi:10.1007/s10956-007-9057-3.

Reinig, B. A., Horowitz, I., & Whittenburg, G. E. (2011). The effect of team-based learning on student attitudes and satisfaction. *Decision Sciences Journal of Innovative Education*, *9*, 27–47. doi:10.1111/j.1540-4609.2010.00289.x.

Reyes, M. R., Brackett, M. A., Rivers, S. E., White, M., & Salovey, P. (2012). Classroom emotional climate, student engagement, and academic achievement. *Journal of Educational Psychology*, *104*, 700. doi:10.1037/a0027268.

Scheyvens, R., Griffin, A. L., Jocoy, C. L., Liu, Y., & Bradford, M. (2008). Experimenting with active learning in geography: Dispelling the myths that perpetuate resistance. *Journal of Geography in Higher Education*, *32*(1), 51–69. doi:10.1080/03098260701731496.

Silberman, M. (1996). *Active learning: 101 strategies to teach any subject*. Boston, MA: Allyn & Bacon.

Smith, C. V., & Cardaciotto, L. (2011). Is active learning like broccoli? Student perceptions of active learning in large lecture classes. *Journal of the Scholarship of Teaching & Learning*, *11*(1), 53–61.

Thomas, E. J. (1972). The variation of memory with time for information appearing during a lecture. *Studies in Adult Education*, *4*, 57–62. doi:10.1080/02660830.1972.11771885.

Yoder, J. D., & Hochevar, C. M. (2005). Encouraging active learning can improve students' performance on examinations. *Teaching of Psychology*, *32*, 91–95. doi:10.1207/s15328023top3202_2.

Appendix: Course 1 initial survey questions

Note: All non–open-ended questions asked on a Likert scale from 1 to 5.

1. How competent/proficient are you at programming in general?
2. How competent/proficient are you at Java programming?
3. How competent/proficient are you at other programming languages?
4. How competent/proficient are you at Java basics: variables, operators (like +, -, =, >, ++, etc.), control structures (like if, for, while, etc.), …?
5. How competent/proficient are you at working with Arrays?
6. How competent/proficient are you at understanding Object-Oriented Programming in general?
7. How competent/proficient are you at working with classes, objects, methods?
8. How competent/proficient are you at understanding and using the concepts of inheritance and polymorphism?
9. How competent/proficient are you at understanding and using interfaces?
10. How competent/proficient are you at understanding and using exceptions?
11. What programming languages do you know other than Java? (if none, just write "none")
12. What grade do you expect to make in this course?
13. How likely are you to drop this class?