Instructor use of Active Learning in Community Colleges and Four-Year Universities

Introduction

Community colleges serve an important role in the development of students in science, technology, engineering, and math (STEM) fields. Most community colleges are open-access institutions, with students coming from all different walks of life to enroll in these schools [1]. These include students directly out of high-school, or those that are returning to school for a second career. When looking that the demographics of community colleges, we find that they serve a disproportionate number of students who are marginalized [2]. These institutions often are a gateway to transferring into a four-year school where a student can continue their education and receive a bachelor's degree in their respective fields.

Despite this potential, most students who enter into a community college will not receive or earn a credential in their area of study within six years after enrolling [1]. The probability a student who begins at community college will obtain a bachelor's degree in STEM was found to be just 0.11, in comparison to their counterparts at four-years schools who have a probability of 0.47 [3]. Students often cite a lack of clarity in the instruction of their courses as well as issues with how their courses are being taught [1, 4]. A potential way to bridge this gap is to increase the instructors use of active learning in these classrooms.

We define active learning as anytime an instructor goes beyond lecturing to students with the students passively learning course material [5-7]. This expansive definition allows us to broadly study activities that prompt students to think more deeply about what they are learning in their classrooms. Oftentimes, active learning includes some elements of collaboration among students, though this is not necessary for active learning to take place in the classroom. The distinction between interactive and collaborative active learning has been explored by prior researchers [8]. Some examples of what active learning could entail are problem-based learning, think-pair-shares, polls/clicker quizzes, or student presentations.

Researchers have found that using active learning in STEM classrooms leads to many positive outcomes for students[5, 6, 9-14]. Students show an increased understanding of the course material and are less likely to fail the class [7, 11-14]. Additionally, students traditionally underrepresented in STEM (first-generation, underrepresented minorities) show improved outcomes in courses that use active learning, such as increased learning and narrowing achievement gaps with their well-represented peers [10, 15].

Despite these benefits, STEM instructors have been slow to adopt active learning in their classes [16-18]. Researchers have sought to understand why the transition from traditional lecture to active classrooms has lagged, especially in STEM courses and have found several barriers that have inhibited instructors from implementing active learning. These include the amount of time it takes to prepare course material, concerns over being able to cover the entire syllabus, concerns over the efficacy of active learning, and fear of student resistance [13, 19-25].

Student resistance can be defined as any negative reaction to active learning, be it through behaviors within the class or an affective response [26]. Some examples could potentially include openly refusing to participate in the activities, giving lower evaluation scores

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to instructors who use active learning, or simply working on another task instead of the activity [12, 22, 27, 28] . Our past research has focused on strategies that instructors can use to reduce student resistance in their classrooms [29-32]. These strategies can be categorized into three overarching themes: *planning, facilitation,* and *explanation. Planning* strategies are those that an instructor uses when developing an activity and can include getting or incorporating student feedback into their activities. *Facilitation* strategies are those that an instructor uses during the active learning activities to help better engage the students in the activity, such as walking around the room and answering questions. *Explanation* strategies focus on how an instructor can introduce or give context to an active learning activity such as an instructor relating the activity back to the lecture or describing why they are doing the activity in the first place.

Much of the previous research focused on active learning has taken place in 4-year university settings. We know that adoption of active learning has been slow in university settings, but the literature does not provide a clear understanding of active learning practices in community colleges. We do not know if community college instructors face similar barriers to implementing active learning in their classrooms, and as such, we do not know if their students are similarly resistant to active learning. This paper seeks to broaden the understanding of active learning in community colleges and highlight how these practices may differ between different institution types.

Methods

For this paper, we will draw on two data sources, one survey and one observational that will be called Study 1 and Study 2, respectively. Study 1 and Study 2 are a subsection of a broader study that focuses on increasing the use of active learning within STEM classrooms. Instructor participants were provided a workshop that explained what active learning is, how to implement it in their classrooms, and strategies for reducing student resistance. We used a randomized-control trial experiment to understand the impact of this workshop, but for Study 1, we will be using data we collected prior to this workshop so that we can give a broader understanding of the current state of active learning in community college classrooms.

We recruited STEM instructors from across the country via email with the incentive to participate in our workshop as well as receive a financial stipend for completing our surveys. Institutions were initially selected to be within 150 miles of our research institutions so that we could travel for in-person observations. IRB and institutional permission were granted for all data collection. So that we could have a broader understanding of active learning across many different institution types, we made sure to recruit from community colleges to research institutions, and everything in between. A total of 155 instructors participated in Study 1, with 27 instructors teaching at community colleges.

Instructors were emailed surveys that measured their use of active learning, the value they saw in using active learning, their use of strategies to reduce student resistance in their classrooms, their self-efficacy towards using these strategies, how their students responded to the activities, and the barriers they encountered when trying to implement active learning in their classrooms. The survey allowed an open space for instructors to describe the type of activity they used in class that day and also asked “Does the activity you described above require students to interact with each other?” The purpose of this distinction is to eventually better understand how

students responses to active learning changes when they are asked to interact with their peers, as opposed to doing an activity that is non-interactive. For this paper, Study 1 will focus on what types of active learning is being used by instructors, as well as whether or not it is interactive.

In Study 2, instructors were recruited to participate in classroom observations with a workshop and monetary incentives being given to participants. These instructors were considered eligible for this study and contacted via email if they were teaching a first- or second-year STEM course, planned to use active learning during that semester, and were available to attend the workshop and schedule classroom observations. After this recruitment, the instructor and researcher communicated to find a time for the observation. All observations took place in the middle of the semester to avoid introduction and exam preparation lessons, and researchers and instructors chose classes in which students would not be taking a major exam. The observation protocol spanned the entirety of a class session. Demographics for both Study 1 and Study 2 are found in Table 1.

	Study 1		**Study 2**	
	Surveyed Community College Instructors (N=27)	**Surveyed Four-Year Instructors (N=128)**	**Observed Community College Instructors (N=12)**	**Observed Four-Year Instructors (N=)**
Gender				
Male	16	73	4	8
Female	10	53	8	4
Other/Unsure	1	2		
Race/ Ethnicity				
White	20	92	5	8
Asian	3	28	3	2
Black	2	3	3	0
Hispanic	1	5	1	0
Native American or Alaskan Native	0	2	0	0
Prefer not to answer	2	8	1	1
Discipline				
Engineering	0	18	1	4
Mathematics	5	59	1	3
Science	21	52	10	5

Table 1: Demographics of Instructor Participants

Twenty-four instructors were observed for the final sample and the IRR (inter rater reliability) of the protocol was determined to have an intraclass correlation coefficient of 0.84, meeting standards for replicability. All observations in the present analysis were conducted by the same researcher and additional data about demographics and institution characteristics were collected. The observation tool was developed using significant findings regarding student resistance behaviors and instructor strategies from prior work [33, 34]. The explanation and facilitation techniques from this work are shown in Figure 1. Use of these strategies was recorded for each instance of active learning along with the medium of active learning (peppered lecture, quizlets, polls, etc). Additional information about student resistance, distraction and participation were also collected but not reported upon here.

Results

In Study 1, we looked at the self-reported interactive active learning survey data, and found that instructors at community colleges are more likely to opt for interactive types of active learning with 84% using interactive activities versus 69% of their counterparts at 4-year universities, as shown in Figure 2. Unfortunately, we did not have a large enough sample size of community college instructors to find this difference at a statistically significant level.

In Study 2, our observational data reflects a varied frequency and breadth of ways active learning is implemented in STEM classrooms. Across the 24 classrooms observed, active learning was recorded 67 times. The mediums of active learning observed in this data set are free form work (n=10), worksheet/ handout (n=14), Professor directed facilitation/ interactive lecture (n=16), student presentations (n=4), poll/ quizlet/ iclicker (n=11), quizzes (n=2), and LARP or Live Action Role Play (n=1). Of note two of these strategies, LARP and quizzes, were only observed in community college classrooms and not classrooms at 4-year institutions.

Instructors at 2-year institutions used a greater average number of different strategies per session (mean=6.25, SD =2.30) and a greater average frequency of total strategies per session (mean = 11.17, SD =7.35) than did their 4-year institution-based counterparts. This difference in

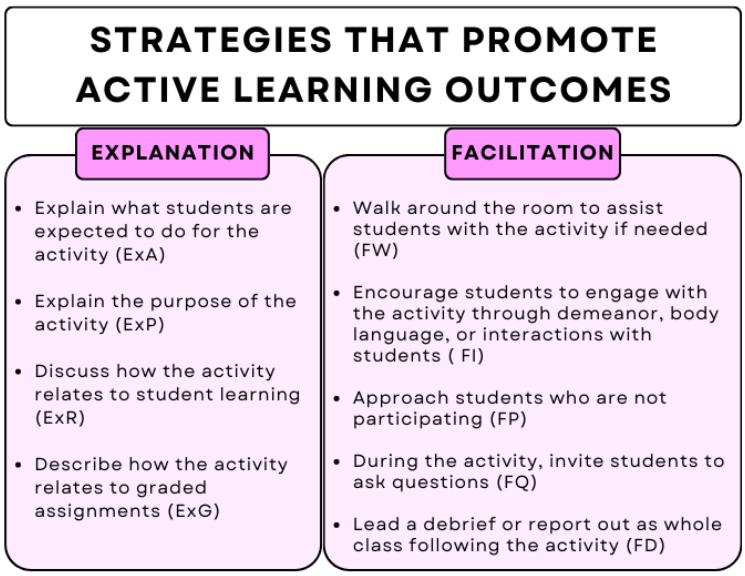

Figure 1: Strategies for Improved Active Learning Outcomes

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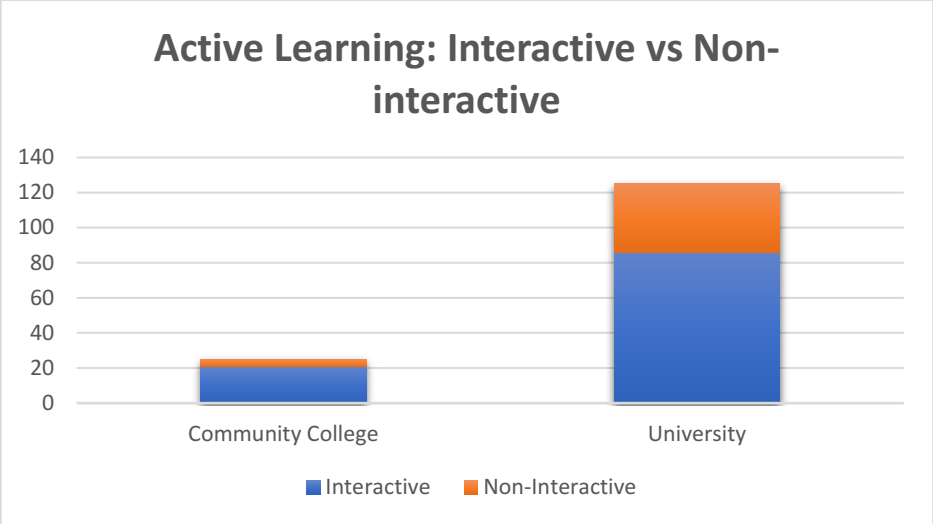

Figure 2: Study 1 results of interactive versus non-interactive active learning in community colleges and four-year universities.

diversity of active learning mediums could be connected to the average class sizes observed. 25% of the 2-year classes observed were classified as medium (15-30 students), and 75% as small (<15 students). At 4-year institutions, 42% were classified as large (>30 students), 33% as medium, and 25% as small.

In a comparison of active learning strategies used during different mediums of active learning, there are some discernable differences between 4-year and 2-year institutions. These differences can be seen in Figure 3. As previously mentioned, 2-year instructors demonstrated a wider diversity of active learning mediums but also demonstrated higher diversity of strategies within each medium. These strategies to mitigate student resistance to active learning were used with varying frequency across community college classroom observations. As seen in table X, FI was used most frequently (93% of the time) followed by ExA (83%). Explaining the purpose of an activity (ExP) was used in only 33% of active learning instances across both 2- and 4-year institutions.

Freeform work generally yielded the lowest frequency of strategy usage. When freeform work was observed, 4-year instructors relied heavily on ExA, FW, and FD. 2-year instructors used these strategies with similar frequency but also incorporated FI and FP just as often. 4-year instructors were also never observed using ExR during free form work. For observations of worksheet/ handout active learning, 2-year instructors used ExA, FW, and FI 100% of the time, whereas their 4-year counterparts only used these strategies about 60% of the time for this style of activity. Further, FD appeared to be a more common strategy for worksheets in 4-year settings than it is in 2-year settings. When observing professor directed facilitation/ interactive lecture, 2-year instructors were much more prone to use FI and ExR, while 4-year instructors favored FQ, FD, and ExA. Additionally, 4-year instructors used ExG about 30% of the time during interactive lecture while 2-year instructors were never observed using this strategy for this type of active learning. We saw the most deviation in usage of strategies when student presentations were observed, where 4-year instructors used some strategies (ExP, ExR, ExG, and FP) that were

Category	Label	Strategy	average # times uses per class by instructor	% Of time observed during a lesson
Explanation	ExA	Explain expectations	2.0	83%
	ExP	Explain purpose	1.0	33%
	ExR	Connect to learning	1.3	54%
	ExG	Connect to grades	1.6	46%
Facilitation	FW	Walk around	1.4	75%
	FI	Interactions and body language	2.2	92%
	FP	Approach students not participating	2.0	46%
	FQ	Solicit questions	2.2	79%
	FD	Lead a debrief	1.9	79%

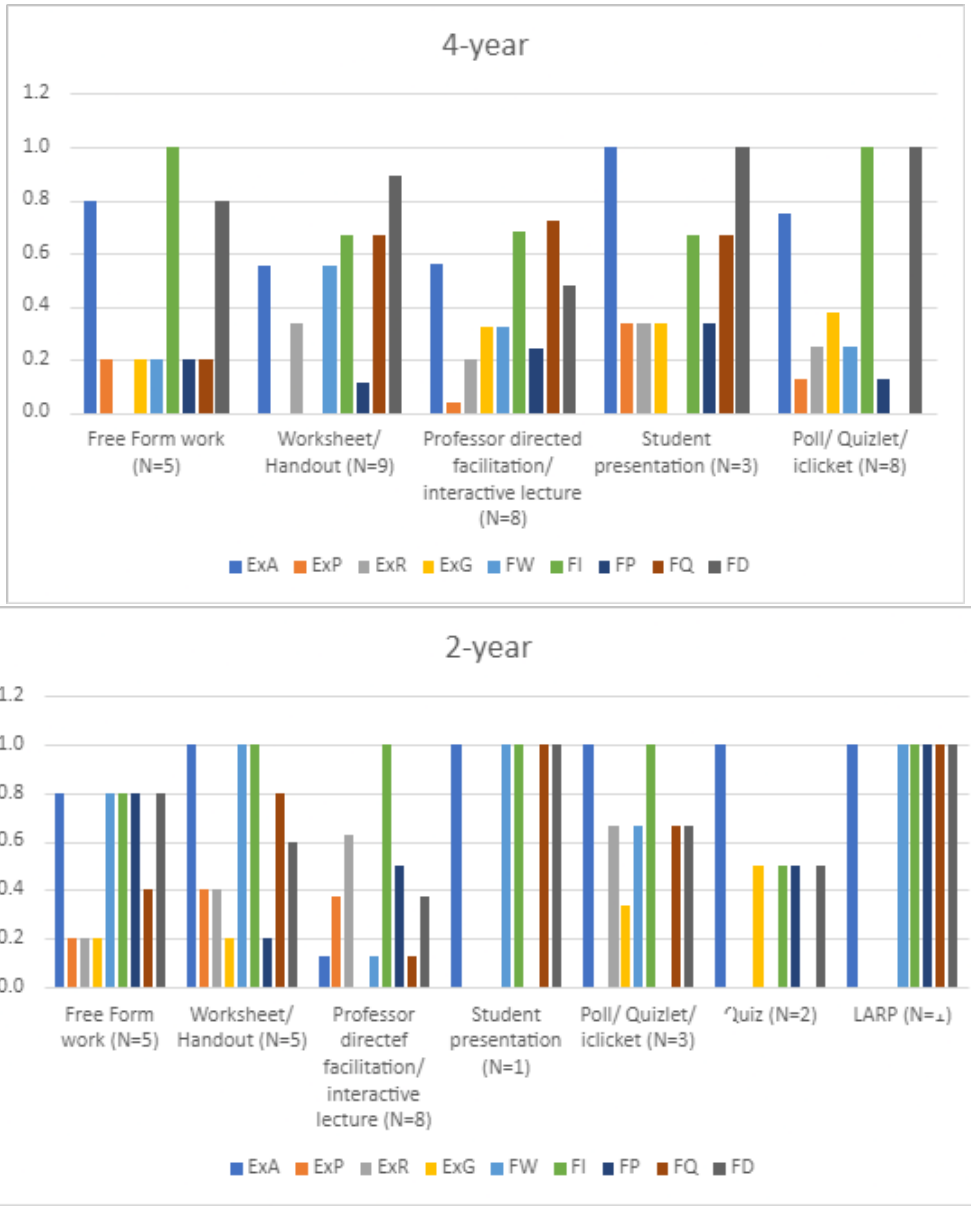

Figure 3: Study 2 observed active learning use and strategy use in classrooms.

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not observed in 2-year instructor's implementation of active learning. Finally, for both 4- and 2-year instructors when polls or iclickers were used as a medium for active learning, FQ was never utilized as a strategy to reduce student resistance. Across the board, instructors at 2-year institutions used these strategies with higher frequency per instance of active learning than did 4-year instructors.

Discussion

Our results point towards community college instructors using more active learning activities that require their students to interact with their peers than instructors in four-year schools. In order to understand why this might be different, its important to understand the differences between these types of institutions. Community colleges typically offer smaller classes in comparison to four-year institutions which may allow for greater ease in having the students interact with each other. This increase in interaction may prove helpful for community college students in that community colleges typically have students that are not anchored to campus with many different extracurricular activities that build community among students. Having an increase in interaction between students may help to build relationships between students that may not be easily achieved otherwise.

Similarly, instructors and community colleges were observed to be using a wider variety of active learning activities. It is interesting that we observed a wider array of activities in community colleges than in four- year schools in that it suggests the community college instructors are thinking more creatively about their teaching, and working to expand upon what a student would typically see in the classroom. Community college instructors also appear to be using more research-based teaching techniques and strategies for reducing student resistance than their counterparts at four-year schools. This is an interesting finding, in that community colleges are usually have access to considerably less funding than four-year universities. As such, instructors at community colleges do not have access to the same amount of resources as those teaching at a university. There are often many resources at four-year universities that are dedicated to helping their instructors understand the research, as well as how to implement it, including access to teaching workshops and research journals. However, community college instructors are of able to focus solely on teaching, while four-year instructors often have to juggle research in addition to teaching, with research often being more highly regarded in tenure and promotion decisions. This difference in focus could help to explain why four-year university instructors do not appear to have as fully embraced active learning and strategies for reducing student resistance in their classrooms.

Future Work

This work showed some potential differences in how faculty are using active learning in their classrooms when comparing community college instructors and four-year university instructors. Additionally, we found that instructors were more actively engaged in employing strategies for reducing student resistance within their classrooms. An important next step in this work will be to investigate what, if any, impact these research-based strategies have on affecting student attitudes and responses towards active learning in their classrooms.

Limitations

The use of an active learning workshop as an incentive for participating in this research likely means that the instructors recruited for this study all were likely already interested in and potentially using active learning in their classrooms. Unfortunately, this means that we are unable to get a fuller picture of instruction in classes where an instructor is less interested in using active learning in their classrooms.

Community college systems are different between different states, as well as within states, as they often have courses designed to meet the needs of local industries. This huge variety of community colleges means that a uniform picture of instruction in community colleges is very difficult to create.

Conclusions

In this study, we found that community college instructors are using more interactive active learning activities, as well as a broader array of types of activities than their counterparts at four-year universities. Additionally, when instructors are using active learning in their classrooms, community college instructors are more likely to engage in and use research-based strategies to reduce student resistance within their classrooms. These results will need to be replicated in a larger sized study of community college instruction in order to gain a better understanding of active learning and curriculum as a whole at community colleges. Additional research should also be conducted to understand how this perceived increase in use of active learning in community colleges translates to student outcomes for the community college students. Community college students are more likely to leave school without a degree, and researchers could focus on how in-class active learning use could possibly lead to higher student retention and improved student outcomes.

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