Pedagogical Practices of Teaching Assistants in Polysynchronous Classrooms: The Role of Professional Autonomy

Greg Mayer, PhD
Academic Professional Associate, School of Mathematics
Georgia Institute of Technology

Dia Sekayi, PhD
Associate Professor, Department of Advanced Studies, Leadership, and Policy
Morgan State University

Polysynchronous learning involves the use of educational technologies to enable remote and face-to-face students to simultaneously participate in live classes. This article uses teaching observation and focus group data to explore the perspectives and instructional practices employed by teaching assistants tasked with facilitating polysynchronous classes. This study's findings suggest that without a sufficient knowledge base, community, and structure to facilitate a teaching environment that extended beyond lecturing, the assistants adopted a knowledge transmission perspective. Based on these findings we discuss teaching practices that could be addressed to train and support instruction in polysynchronous environments.

Educational programs and courses that provide synchronous instruction simultaneously to face-to-face and distance students allow for greater access equity for those students who are geographically isolated or cannot physically attend lectures (Bower, Kenney, Dalgarno, Lee, & Kennedy, 2014; Li, Amin, & Uvah, 2011; Morely, Usselman, Clark, & Baker, 2009). Some research findings suggest that this particular form of blended synchronous learning (BSL) leads to improved course and program completion rates for students who participate in synchronous sessions rather than relying solely on asynchronous communication (Norberg, 2012; Power, 2008; Power & Vaughan, 2010). This format can also allow participants to experience an instructor's live lesson, ask and answer questions, offer comments in class and allow engagement "in a similar manner to on-campus students" (White, Ramirez, Smith, & Plonowski, 2010, p. 35). BSL has also been used to promote in-class discussion and cooperative learning (Roseth, Akcaoglu, & Zellner, 2013; Stewart, Harlow, & DeBacco, 2011; Szeto & Cheng, 2016).

One of the challenges related to this particular format which has not been extensively studied pertains to the teaching practices of teaching assistants who are tasked with facilitating live instruction to both local and distance learners at the same time. Teaching assistants who are assigned to facilitate instruction in this environment are tasked with simultaneously meeting the needs of their local students, their distance students, and the instructor. Moreover, as Norberg (2012) pointed out, in these environments, "teaching demands increase exponentially" (p. 330). This is consistent with the findings that instructors in BSL greatly benefit from having instructional training and support in the classroom during live sessions (Bower et al., 2014; White et al., 2010). Yet at some of the largest higher education institutions in the U.S.A., educational development for TAs tends to focus on acclimating them to the

institutional culture, active learning, and other practical matters such as grading (Harris, Forman, & Surles, 2009). In our ever technologically evolving world with increasing availability of blended, polysynchronous, and online formats, TA training that covers the nuances of online instructional delivery is still the exception and not the rule.

Literature Review

Simultaneously teaching remote and face-to-face students in synchronous live classes is referred to as BSL, but has also been defined as polysynchronous learning (Dalgarno, 2014), and multi-access learning (Irvine, Code, & Richards, 2013). BSL environments present unique challenges to instructors, both pedagogically and technologically (Norberg, 2012). Educators have made a number of recommendations regarding effective facilitation in these environments, including limiting student enrollment (White et al., 2010) and offering additional technical pedagogical support to both instructors and students during such classes (Bower et al., 2014).

Swan et al. (2000) suggest three important elements of a successful online course: (1) a transparent and high quality interface; (2) an interactive and high quality instructor; and (3) dynamic instruction with authentic and valuable discussion between faculty and students and among the students. This review of the literature will focus on elements 2 and 3. This paper applies Swan's discussion of the instructor's role in the success of an online course to that of the Teaching Assistants, who have full responsibility for the delivery of instruction in a distance education program. The literature review culminates with a discussion of the theoretical framework through which the data are interpreted.

Blended and BSL Environments

BSL is a form of blended learning, which currently plays a significant and promising role in higher education and has been the focus of several reviews in the distance education literature (Allen, Seaman, & Garrett, 2007; Drysdale, Graham, Spring, & Halverson, 2013; Garrison & Kanuka, 2004; Graham, Woodfield, & Harrison, 2013). The existing literature has focused on comparisons between blended learning and other modalities, on higher education, and on practical and logistical matters. These reviews call for further research on blended learning in areas involving student engagement, K-12 environments, and professional development and training. Moreover, the existing literature on blended learning suggests that although teaching assistants play a vital role in undergraduate instruction, very little research has been conducted on the role and preparation of teaching assistants in blended learning, let alone BSL settings.

The role of TAs has been explored in case studies involving BSL environments. For example, Bower et al. (2014) describe seven case studies where levels of student interactions in a blended synchronous environment varied from "lightweight to tightly coupled" (p. 261). While there were clearly benefits to instructor-student and student-student interaction, the intensity of a blended synchronous structure challenged even the most experienced teachers. Bower (2014) describes how managing the various aspects of such a class, such as attending the

needs to multiple groups of learners and the technology simultaneously, can be psychologically draining. The majority of the instructors in their study said that they benefited from having a teaching assistant in the room while they were facilitating instruction.

White et al. (2010) described a case study that explored the implementation of an undergraduate course that offered lectures to roughly 100 distance and local students at the same time. Study findings relied on interviews with students, a TA, an instructor, and support staff. The teaching assistant was in the room during lectures to help answer questions that students might have. The researchers found that student participation in this blended format increased when comparing to a similar face-to-face course, and the "most challenging aspect of the project for the TA was when technical issues arose"(p. 38). In both of these case studies however, TAs supported synchronous instruction with the presence of a faculty member in the classroom. Morley et al. (2009) reviewed the first four years of a blended synchronous program for advanced high school students at the Georgia Institute of Technology. The report stated that teaching assistants are responsible for facilitating instruction for roughly 40% of the learning sessions, but the experiences and perspectives of teaching assistants were not characterized. The paper summarized some of the technical aspects of the program and its success in offering higher education courses to remote students spread across Georgia. However, given the direction of blended learning in higher education, further research on the role of TAs tasked with facilitating instruction in BSL environments is needed.

Interactive and High Quality Instruction

Kester, Kirschner, and Corbalan (2006) found that the quality of interaction is an important component in the online learning environment. The quality of the instruction is impacted by the instructor's level of comfort with the task. Effective face-to-face instructors, even experienced ones, need educational development related to virtual pedagogical strategies. Bower (2011) posits that "teaching effectively in web-conferencing environments is not a simple matter of transferring face-to-face approaches" (p. 262). Though Bower writes specifically about instruction facilitated through web-conferencing software, the same can be said for any instruction that is not face-to-face. Technical proficiency alone is not sufficient; effective instructors must be taught how to blend pedagogical skills with the technology (Reushle & Locke, 2008).

Instructor-Student and Student-Student Interaction

Students want the face-to-face element of their interaction to be thoughtful, substantive and well integrated into the course (Stewart et al., 2011). While there are clearly benefits to instructor-student and student-student interaction, the intensity of a polysynchronous structure can challenge even the most experienced teachers. Managing the various aspects of a polysynchronous class, such as attending the needs to multiple groups of learners and the technology simultaneously, can be psychologically draining. The implications for this "cognitive overload" described by Bower et al. (2014) would certainly have even greater implications for teaching

assistants (TAs), particularly those who have not been exposed to explicit pedagogical training for the technology in use.

TAs Status and Perspectives as Teaching Professionals

TAs are not teaching professionals in the strictest sense of the term. Literature describing teaching professional development and challenges K12 teachers or college faculty encounter in traditional face-to-face and all other varieties of online, blended, and polysynchronous learning environments indirectly, and sometimes directly, presume the professionalism of the instructor. Shanker (1985) defines the true teacher professional as "a person who is an expert, and by virtue of that expertise is permitted to operate fairly independently, to make decisions, to exercise discretion, to be free of most direct supervision" (pp. 10, 12). Despite a fair amount of control over what happens in a recitation, the larger structure of the class from which the recitation emanates is out of the hands of the TA.

TAs and faculty are similar with regard to their perspectives of online and hybrid teaching. Allen and Seaman (2013) report that though the number of students taking online courses has steadily increased, faculty confidence in online and hybrid approaches to teaching has not changed significantly since 2002. Sheffield, McSweeney, and Panych (2015) write that even after engaging in professional development related to online and blended learning, TAs in their study still strongly prefer face-to-face experiences in both their instructional and student roles.

…motivations for teaching can stand as the primary difference between the TAs and faculty.

While there are many similarities between faculty and TAs, motivations for teaching can stand as the primary difference between the TAs and faculty. In the context of the present study, faculty are driven by pressure (and desire) for high scholarly productivity in the form of grants, journal articles, patents, and conference presentations. While most students are largely focused on their own research, with particular focus on the requirements for degree completion, their teaching experience is often either required as departmental service or is the only source of funding available to them.

The present research highlights TAs because they have the most frequent contact with the students enrolled in the classes and through their role as TAs, may have more pedagogical training than faculty, who are not typically required to participate in this kind of professional development. Philipp, Tredder, and Rich (2016) report that though faculty and graduate teaching assistants have deeper content knowledge, UTAs often have more formal pedagogical training. The TAs in this study are experienced TAs who enjoy teaching and take their roles quite seriously; their perspectives are uncommon and worthy of focus within the context of this study.

Theoretical Framework

Ryan and Deci's (2000) self-determination theory (SDT) provides a structure through which the findings of this study can be interpreted. SDT is organized around the constructs of competence (the possession of relevant knowledge), relatedness (a

sense of community), and autonomy (a sense of agency). These three categories play a role in the enhancement or undermining of motivation and the resulting performance. In the discussion that follows, we provide evidence that TAs who participated in this study experienced gaps in relevant knowledge related to instructional delivery in an unfamiliar class structure. Furthermore, they desired a sense of community with other TAs and proactive involvement of more experienced faculty and staff to support active learning. Finally, to mitigate classroom challenges, they exercised pedagogical autonomy.

Methodology

A mixed methods approach was used to answer the following research questions.

1. What teaching practices do TAs, who facilitate in polysynchronous environments, use in their recitations?
2. How do TAs describe their experience facilitating recitation sessions in a polysynchronous learning environment?

This study employs qualitative hypotheses as the first stage of the modified analytic induction process used in the analysis; the hypotheses were informed by the literature and the investigators' experience with the program under study and are included in the Appendix. The qualitative piece for this mixed-methods study involved the use of focus group interviews. The quantitative component of this study involved the use of a modified version of an established framework for the collection of teaching observation data: COPUS. The aim of exploring the above research questions is to help identify strategies to better support teaching assistants, both pedagogically and technologically, who navigate a complex instructional environment.

Context and Sample

The context of this study is a distance education program that offers semester-long multi-section mathematics courses to high school students (Morley et al., 2009; Mayer, 2016). These courses are simultaneously offered to undergraduate students and to high school students who are located throughout a southeastern state in the USA. High school students are unable to attend lectures on campus and participate in this program through distance education. This study pertains to a mathematics course that explored Linear Algebra and Integral Calculus that is offered as synchronous 50-minute sessions five mornings per week for sixteen consecutive weeks. Local undergraduate students participated in this course through a live face-to-face format. All students view live lectures that are facilitated by an instructor on three of these mornings. On the other two mornings, students are divided into smaller sections for recitations that are facilitated by a TA.

All TAs were either graduate or undergraduate students and were employed by an academic unit that sponsors its own course-based training. The unit also requires TAs to participate in university-wide training hosted by the campus teaching and learning center (Utschig, Carnasciali, & Sullivan, 2014). What is covered in their TA

training is a variety of instructional strategies for face-to-face learning environments. Taken together with a group of bright and creative TAs, the result is a sense of pedagogical autonomy that allows TAs to adapt their instruction to a challenging context. All TAs were given the autonomy to identify and facilitate learning activities for their sessions that are aligned with course objectives and assessments. TAs for this particular course had also attended an additional training session on how to communicate using web-conferencing technologies, although they were not offered training on teaching in a polysynchronous education environment.

Two recitation formats were offered in Fall 2015. One section used Adobe Connect to facilitate recitations with 25 remote high school students. These students were loaned Wacom Bamboo tablets in order to write on a shared white board, allowing frequent interaction with their TA.

The remaining seven recitation sections had a combination of undergraduate students who participated in recitations face-to-face and remote high school students who connected to recitations through video or web conferencing software. When a student at a remote site wanted to communicate with their TA during a recitation, the student could press a particular button on their equipment, at which point the student would be shown on large screens in the lecture hall and can converse with the TA. These TAs could see and interact with their local students, and could see only one high school - whichever school was the last to communicate with the TA. In previous iterations of these courses, teaching assistants have pointed out that students rarely exercise this option.

The researchers invited all TAs who were assigned to the course described above offered in Fall 2015 to participate in the study; four of the eight TAs agreed. The number of students who were assigned to each TA is shown in Table 1. TA names were replaced by letters to maintain confidentiality.

Table 1
Recitation Structure

TA	Participation format	Number of local students	Number of distance students
A	blended	22	51
B	blended	15	49
C	blended	9	76
D	online only	0	25

Data Collection Methods

Data collection methods included semi-structured focus group discussions with TAs and teaching observations data based on the COPUS framework (Smith, Jones, Gilbert, & Wieman, 2013). The COPUS protocol documents teaching behaviors in two-minute intervals throughout the duration of the observed class session. The original COPUS protocol is limited to 25 codes in only two categories ("What the students are doing" and "What the instructor is doing"). However, this study only

focused on teaching assistants: only the 11 codes that pertain to the actions of the instructor were used. This observation instrument was developed for face-to-face classes taught by an instructor. The COPUS was modified based on the observed dynamics in recitations. These modifications are discussed in the discussion section.

Focus group discussions were facilitated by one of the study investigators. The investigator who conducted the focus groups has more than 20 years of experience as a qualitative researcher; she has taught qualitative methodology, guided qualitative dissertations, and written and presented on the topic of qualitative methods. The focus groups were audio recorded, transcribed verbatim, and coded. Recitations were video-taped and archived using video archiving software. These videos were used to investigate what activities teaching assistants incorporated into their recitation sessions. Teaching observations were conducted using a modified version of the COPUS. Researchers used the COPUS to identify what activities the teaching assistants were implementing at two-minute intervals.

Data Analysis

In the next section we present the storyline or theory of the data. We arrived at the storyline via a convergence of two forms of analysis: (1) an abbreviated grounded theory process and (2) a process of modified analytic induction (MAI). We will first describe these processes and then present the resulting analysis.

We began our data reduction by using abbreviated Grounded Theory (Willig, 2013). Traditional Grounded Theory is an approach that combines data collection and analysis to arrive inductively at a theory grounded in the data. This approach is unique in the way it combines theoretical sampling and constant comparative analysis via the steps of open, axial, and selective coding. The open, axial, and selective coding steps are so useful that they are often borrowed and used as an effective way to organize and analyze data, therein an abbreviated version of the traditional approach. We made use of these steps in the present study since our main method of analysis does not provide its own structure for initial data reduction

After the application of open, axial, and selective coding, we employed the MAI process. This process is also used to generate a theory of the data. The name is somewhat deceiving as the process begins with working hypotheses or assumptions (WHA) about the data. The data are then held up to the working hypotheses and checked for alignment. Absent perfect alignment, either the hypotheses are modified to capture the data or new hypotheses are created to account for said data (Robinson, 1951).

The categories generated by open and axial coding are useful as a source for the development and revision of WHAs. Though we entered the data collection process with some WHAs from the literature and experience with the program under study (listed in the Appendix), other WHAs were identified during the data collection and analysis processes. Tables present the final list of hypotheses along with statements made during the focus group discussions. Taken together, the final hypotheses form the storyline of the data.

The Storyline

The final step of the coding process from the abbreviated version of grounded theory is selective coding. During this phase of the analysis we identified a single central theme that ties all of the data together (the storyline). The focus group and observation data suggest the following: TAs experience pedagogical challenges that stem from some combination of limitations in TA preparation for a hybrid program delivery, technologies used to deliver the program, and curriculum support TAs receive from distance and local faculty and staff once engaged in the program. Despite these challenges, TAs enacted pedagogical autonomy to facilitate their recitations in ways that met the needs of distance and face-to-face students based on their existing knowledge and the resources that were available to them.

Discussion of Findings

The TAs who participated in this study reported that they encountered challenges and frustration when facilitating their recitations. In this section we interpret our data using four categories; the first three correspond to the dimensions of Self Determination Theory.

- The knowledge dimension pertains to support provided in advance of the experience.
- The community dimension pertains to support provided during this teaching experience. This support can be offered through interactions between the TA and university faculty and staff, high school staff, or other TAs.
- The agency dimension pertains to how TAs enacted their autonomy to facilitate their recitations to meet the needs of local and/or distance students.
- The program structure dimension pertains to elements of course design that would have affected the facilitation of recitations.

Knowledge

The WHAs presented in Table 2 on p. 138, generated and refined based upon the data, are presented as documentation of TA knowledge. The variable *N* represents the number of TAs who made a statement during a focus group that was coded as one of the WHA's. Table 2 also provides example statements for each WHA.

With regard to K1, none of the TAs received pedagogical training on how to instruct with both distance and local students simultaneously. Yet during the focus group discussions, TAs expressed how prior training could impact their work. These findings are consistent with research on fully online environments mediated over web conferencing software. Kear, Chetwynd, Williams, and Donelan (2012) found that instructors "need practice to build the skills, knowledge and confidence to support their students in web conferencing environments" (p. 961).

Table 2

WHA Corresponding to the SDT Knowledge Dimension, and TA Focus Group Statements

Code	WHA	N	Examples
K1	The TAs that had both local and distance students struggled with finding ways to meet both the needs of both groups of students simultaneously based on variations in student location and ability.	3	"I think it was a hindrance having both, because I think they need to be interacted with differently." "Do I teach at this more basic level so that everyone can understand what I'm saying? Or do I teach at a more upper level so that I might lose a lot of people? That's probably the biggest challenge for me."
K2	TAs experienced frustration because they did not know how to foster a higher level of student participation/engagement.	3	"I think this semester personally was very frustrating, teaching it, because I have a certain teaching style, I'm very interactive" "I guess my experience this semester has been probably five questions all semester from the students in high schools"
K3	TAs believe that their prior training and experience impacts the quality of the courses they are assigned to.	3	"maybe a few mock sessions, something like that, because it is indeed different"
K4	TAs wanted to facilitate engaging classes.	4	"I guess ideal would be very obviously engaged in question-asking and understanding the material."

TAs in focus groups also described how they struggled with meeting the needs of both groups of students, as some of the active learning strategies they used in the past would not have worked well with a blended format. These findings may be related to, for example, the fact that admission requirements into the distance courses for high school students are more stringent than those for the university undergraduate program. High school students have been found to outperform their undergraduate level peers (Morley et al., 2009).

Community

Table 3 on p. 139 presents the WHAs that correspond to the SDT Community dimension and TA statements made during focus group discussions.

Table 3
WHA Corresponding to SDT Community Dimension and TA Statements

Code	WHA	N	Examples
C1	TAs want distance site and/or local faculty and staff to play a proactive role in facilitating recitations or supporting the TAs.	2	"I would really like to see the proctors be more involved" "I wish we did meet together more"
C2	TAs believe that the support they receive during course delivery impacts the quality of the courses they were assigned to.	4	"the technician was great. I think he was new but he got everything running perfectly" "the in-class support on the technology has been fantastic" "I had to solicit a lot of information from the professor to see how the class itself was doing. I was able to get help when asked"

TAs expressed that they want distance site and/or local faculty and staff to play a proactive role in facilitating recitations or supporting their live sessions. This finding is consistent with Bower et al. (2014), who found that instructors teaching in BSL environments expressed the desire for additional support for teachers during their classes to ensure that "the communication is flowing well through both environments" (p. 269). White et al. (2010) also found that having additional in-class support from someone "familiar with the structure of the course, required assignments, and course content" (p. 38) was vital. Assessing the feasibility of coordinating efforts with high school facilitators in the context of this study extends beyond the scope of this research. However, TAs did report that they received help any time they requested it and that it had an impact on the overall quality of the program.

Agency

Table 4 on p. 140 presents the WHA's and corresponding statements made during focus group discussions that correspond to the SDT Agency dimension.

The K12 education literature addresses the issue of teacher autonomy extensively; particularly as it relates to the challenges created by a context dominated by externally imposed curricular standards and classroom structure (Retsinas, 1983; Pearson, 1998; Webb, 2002). Course size, structure, and technology are all determined by faculty and administrators in the distance education program. This structure imposed by the university and the instructor of record regarding the courses for which TAs facilitate the recitations could pose a similar challenge to TA enactment of autonomy. Powell and Rouamba (2016) report that graduate teaching assistants have little control over the content and pace of their assigned courses. In the present study, the focus of TAs' work in recitations, while in some ways autonomous, is also dictated by the topics covered in the main course session taught by a faculty member.

Table 4
WHA Corresponding to the SDT Agency Dimension and TA Statements

Code	WHA	N	Examples
A1	Regardless of their personal teaching perspectives, TAs with both local and distance students spent most of their time, in recitation, lecturing to students; based on the structure of their course, moving beyond lecture was difficult.	3	"We have no idea how to actually work with them, so we just sit there and lecture." "the idea of doing things like do group work … were alien because I saw that I have no control over the students over there." "I feel like to properly interact with them, you would have to really sit down with someone and say ... and really learn the teaching techniques. We as grad students don't have time for that."
A2	The one TA who did not have local students facilitated more student-instructor interactions than those TAs teaching in a blended environment.	1	"I had a very, very close relationship with all my distance students and we talked all the time, because I don't get to see them, they don't come to school, I don't see, so we always text each other. It was a completely different experience for me."

Unsure of how to interact with their distance students and how to meet the needs of both local and distance students simultaneously, TAs A, B, and C enacted their autonomy by adopting a knowledge transmission teaching perspective. This is a very different situation than that described by other researchers (Bower et al., 2014; Roseth et al., 2013) who found that local and distance students could be engaged simultaneously in a variety of ways during synchronous sessions. This difference could be attributed to several factors, including differences in training, the capabilities of the technologies that were being used, or the comparative student-TA ratios. Indeed, TA D, who only had 25 distance students, described how student-TA interactions were a more frequent component of recitations and how that interaction enabled the development of online community. Web conferencing software that can facilitate breakout rooms and instant messaging has been found to be effective in fostering community among learners in the distance education literature (Martin & Parker, 2014).

Structure

WHAs S1, S2, and S3 captured data that described how TAs perceived the impact of the structural elements of the course on program quality (see Table 5 on p. 141).

Table 5
WHA Corresponding to SDT Program Structure Dimension and TA statements

Code	WHA	N	Examples
S1	TAs believe that improvements to the technologies they use during recitations are needed to engage all students.	4	"Maybe ability for us to be able to communicate, not just via voice or be able to write things, I think that would be really helpful" "Very often there a voice comes distorted, they have to repeat a few times."
S2	TAs believe that high school students and local undergraduate students should not be placed into the same recitation sections.	3	"Mixing live students and distance students is not appropriate because it's unfair for the live students." "It's not working. They need to be separated."

TAs narrated structural challenges throughout their focus group discussions. TAs described limitations in their ability to engage their distance student based on the particular technologies that were chosen to facilitate recitation sessions. Although they all felt that they had adequate technical support for the technologies they were using (C1), all of them felt that they were not able to adequately engage all students. To do so, they felt that improvements were needed in the technologies they were using or that the local and distance students should not be placed into the same recitation sections. This perspective is different from that reported by Bower et al. (2014), who did not recommend keeping distance and local students separate, but rather facilitating meaningful interactions with distance and local students simultaneously. These differences in perspectives might be explained by student enrollment numbers, training, or by the capabilities in the technologies that were being used.

Teaching Observation Data

Live classes and video of recitations were coded using a modified version of the COPUS. Codes that were added to the COPUS are defined in Table 6 on p. 142.

As there remains some debate in the education literature over how to best measure internal consistency (Bower & Hedberg, 2010, p. 469; De Wever, Schellens, Valcke, & Van Keer, 2006, p. 10), we calculated the percentage agreement and the Cohen's kappa inter-rater reliability score, which were 97% and 91%, respectively.

Results from the teaching observations for the three TAs that had both local and distance students are shown in Table 7 on p. 142. The table gives the number of sessions in which each action in the modified COPUS protocol was observed and a count of the times each action was observed in two-minute intervals across each recitation. As there were a total of 134 two-minute intervals among the six observed sessions, the final column gives the percentage of intervals among them that contained at least on instance of the corresponding action. For example, answering questions

posed by students was observed in three of the six observed sessions, during 4 two-minute intervals, or within 3% of the observed time intervals.

Table 6
Teaching Observation Codes Added to the COPUS Codes

Code	Code Name	Definition
TIP	Tip for students	TA states additional conceptual information that is not essential to the understanding of course material.
TOW	Talk about writing	TA discusses the process of writing, or is repeating what they are writing.
DSI	Discusses student input	Discusses statement made by student, in response to a question posed by the TA.
SQ	Solicit question	TA encourages or invites students to ask the TA questions.
RQ	Rhetorical question	TA asks question and does not expect answer from students

Table 7
Teaching Observation Results for TAs A, B, and C with Local and Distance Students in their Recitations

Code	Action	Sessions	TA	Count	Frequency
RtW	Real-time writing	6	3	127	95%
Lec	Lecturing	6	3	122	91%
SQ	TA solicited questions from students	6	3	25	19%
NPQ	TA asked their students a question	6	3	19	14%
W	Waiting	6	3	17	13%
TIP	TA verbally described a tip to their students	5	3	32	24%
ADM	Administration	5	3	10	7%
TOW	Talking about writing	3	2	32	24%
APK	Activated prior knowledge	3	3	10	7%
AnQ	TA answered a question posed by a student	3	2	4	3%
1o1	TA engaged in one-on-one conversation with student	1	1	5	4%
MG	Moved about the room	1	1	4	3%
FUp	Follow-Up to a question posed by a student	1	1	1	1%
DV	Showing or conducting a demo, experiment, simulation, etc.	0	0	0	0%

Table 7 suggests that, among those recitations that were observed in person, TAs A, B, and C spent most of their time lecturing to their students and writing on the board. Moving about the room to engage with students and one-on-one conversations

were only observed in one recitation. And although soliciting questions in 19% of the two-minute intervals, only 3% of them contained instances of answering questions posed by students. Altogether, we found that the TAs put forth effort to engage their students primarily by soliciting questions, but little TA-student interaction was observed.

Figure 1 below gives the percentages of the two-minute intervals among all eight observed sessions among them that contained at least one instance of the corresponding teaching activity. For example, all TAs were lecturing over 80% of the time intervals. Meanwhile, TA D spent significantly more time asking and answering questions posed by students.

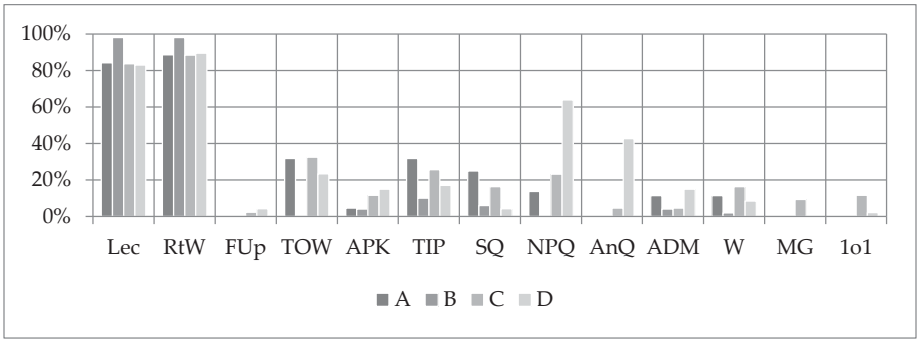

Figure 1. Percentage of Time Spent on Teaching Activities

The observed sessions that were facilitated by TA D contained relatively more questions posed by the TA to students and answers to questions posed by students. Results presented in Figure 1 confirm hypothesis A2: the TA that did not have local students was able to interact more frequently with her distance students.

Transferability

Merriam (1998) presents transferability as the qualitative response to generalizability. While qualitative research is designed to study the nuances of the sample selected for any given study and is not intended to be generalizable, it is safe to say the most researchers want the findings of their research to be meaningful. While one should not expect statistical generalizability from this study, the findings have the potential to be useful in other similar settings. The researchers' contribution to transferability is the presentation of a detailed description of the case at hand so that readers can determine the applicability of the findings to their settings.

Limitations

The results of this study are based on a small group of teaching assistants, and as such, the observed group dynamics lie in the particular activities and structures that these teaching assistants facilitated. While it was the intention of the researchers to study all eight TAs working with the program during the semester of the study, there was no ethical way to compel their participation. To enhance the credibility of the

analysis and transferability of study findings, the researchers collected data from as many TAs who were willing to participate and are currently refining the working hypotheses by conducting a follow-up study with additional participants. Teaching practices in this study were also constrained by the features afforded by particular technologies that were used. Also, the courses under consideration were mathematics courses, and it is possible that the subject matter influences the strategy that engages students during recitations. Finally, admission requirements for the high school students participating in this program were more stringent than for the local undergraduate students. Past studies have found that the high school students consistently outperform the local students in these courses (Mayer, 2016; Morley et al., 2009). Further work would be needed to enhance the transferability the results of this study. Despite these limitations, TA training programs might apply these findings when developing or revising their curricula. Specific pedagogical practices for polysynchronous teaching should certainly be included in the curriculum if TAs are expected to teach in non-traditionally structured classrooms.

Conclusions

The exercise of TA autonomy is a notable finding. Without a sufficient knowledge base, community, and structure to facilitate a teaching environment that extended beyond lecturing, the TAs in this study chose to adopt a pedagogy based on knowledge transmission. Although the COPUS does not measure TA satisfaction, focus group data suggest that participants A, B, and C experienced frustration with their transmission and lecture-focused teaching practices.

Although it was not the intention of this study to identify and evaluate interventions that may address some of the frustrations and challenges that were identified by the TAs, connections can nonetheless be drawn between these challenges and findings that were summarized in the literature review section above. The university-wide TA training that all participants in this study participated in focused on active learning in face-to-face settings (Utschig et al., 2014). Teaching strategies for online and polysynchronous learning could be accommodated into the university-wide training as in Sheffield et al. (2015), or as a separate training session for those who are teaching assistants for these environments.

Adaptations to the Teaching Assistant training program should include research based content on how learning online is similar to and different from classroom learning. In addition to the enhanced content, TAs should have the opportunity to practice teaching online as they do face-to-face. In order to achieve mastery, guided practice with constructive feedback is key (Ambrose, Bridges, DiPietro, Lovett, & Norman (2010). Microteaching is already part of the advanced pedagogical training at this institution; similar opportunities for application in an online setting would be worthwhile for all TAs.

Utschig et al. (2014) found that TAs feel more valued when faculty support departmental TA programming (p. 19). Sheffield et al. also found that given the opportunity to learn, with support and experience gained through online training, graduate students and future faculty can gain awareness, competence, and confidence regarding teaching and learning online (2015, p. 10). This may also be the case for the

web conferencing format that TA D employed which did not have local students. Bower (2011) found that more active learning approaches required a range of new competencies relating to managing group work and designing the learning environment (p. 79).

In addition to more support in advance of their teaching sessions, future iterations of this distance education program could also explore changes to the support structures that TAs have while the program is running. For example, TAs and distance students could be provided worksheets that might help TAs focus more time on developing their teaching practices rather than on developing curriculum. TAs could also be encouraged in their training to encourage students to work on problems individually or in groups before discussing their solutions and walking around the classroom to assist local students as they are working on problems. These adjustments may help foster a learning environment that supports some of the elements described in the literature review, including the fostering of active learning, rapport between local students and TAs, and authentic and valuable discussion between instructors and students (Philip et al., 2016; Swan et al., 2000). Further developing the community that supports TAs facilitating learning in a polysynchronous environment may help them better meet the needs of their instructor and the two groups of students simultaneously and address their frustration.

Ultimately the findings presented in this study suggest TA training and support, as well as program structure, can play a role in shaping the teaching practices that are used by TAs during recitations. Educators setting up or revising similarly structured blended learning courses may wish to carefully consider how local and distance students and their instructors could be supported in ways that would best meet the needs of both groups of students simultaneously.

While the findings are not particularly surprising, the process was thorough and perhaps worthy of replication. The researchers collected focus group and observation data (COPUS). The researchers used a process of modified analytic induction which begins with a set of working hypotheses that were developed using the literature and the researchers' experience with the program under study. The data were initially reduced using abbreviated grounded theory, then the process of hypothesis (working assumption) revision was employed. All data were meticulously considered and integrated into the hypotheses to arrive at the storyline of the data. The researchers were able to explore the experiences and practices of teaching assistants from multiple vantage points that included TA self-report, external observations, and program documents. Other investigators might find this research model useful.

References

Allen, I. E., Seaman, J., & Garrett, R. (2007). *Blending in: The extent and promise of blended education in the United States*. Newburyport, MA: Sloan Consortium.

Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States*. Newburyport, MA: Sloan Consortium.

Ambrose, S. A., Bridges, M. W., DiPietro, M., Lovett, M. C., & Norman, M. K. (2010). *How learning works: Seven research-based principles for smart teaching*. San Francisco, CA: John Wiley & Sons.

Bower, M., & Hedberg, J. G. (2010). A quantitative multimodal discourse analysis of teaching and learning in a web-conferencing environment: The efficacy of student-centered learning designs. *Computers & Education*, *54*(2), 462-478.
doi: 10.1016/j.compedu.2009.08.030

Bower, M. (2011). Synchronous collaboration competencies in web-conferencing environments: Their impact on the learning process. *Distance Education, 32*(1), 63–83.
doi: 10.1080/01587919.2011.565502

Bower, M., Kenney, J., Dalgarno, B., Lee, M. J., & Kennedy, G. E. (2014). Patterns and principles for blended synchronous learning: Engaging remote and face-to-face learners in rich-media real-time collaborative activities. *Australasian Journal of Educational Technology, 30*(3), 261-272.

Dalgarno, B. (2014). Polysynchronous learning: A model for student interaction and engagement. *Rhetoric and Reality: Critical Perspectives on Educational Technology. Proceedings ascilite Dunedin*, *2014*, 673-677.

Drysdale, J. S., Graham, C. R., Halverson, L. R., & Spring, K. J. (2013). Analysis of research trends in dissertations and theses studying blended learning. *Internet and Higher Education*, *17*(1), 90–100.
doi: 10.1016/j.bbr.2011.03.031

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95-105.
doi: 10.1016/j.iheduc.2004.02.001

Graham, C. R., Woodfield, W., & Harrison, J. B. (2013). A Framework for institutional adoption and implementation of blended learning in higher education. *The Internet and Higher Education*, *18*, 4-14.
doi: 10.1016/j.iheduc.2012.09.003

Harris, G., Froman, J., & Surles, J. (2009). The professional development for graduate mathematics teaching assistants. *International Journal of Mathematical Education, 40* (1), 157-172.
doi: 10.1080/00207390802514493

Irvine, V., Code, J., & Richards, L. (2013). Realigning higher education for the 21st century learner through multi-access learning. *Journal of Online Learning and Teaching, 9*(2), 172-186. Retrieved from http://jolt.merlot.org/vol9no2/irvine_0613.htm

Kear, K., Chetwynd, F., Williams, J., & Donelan, H. (2012). Web conferencing for synchronous online tutorials: Perspectives of tutors using a new medium. *Computers & Education, 58*(3), 953-963.
doi: 10.1016/j.compedu.2011.10.015

Kester, L., Kirschner, P. A., & Corbalan, G. (2007). Designing support to facilitate learning in powerful electronic learning environments: Introduction. *Computers in Human Behavior, 23*, 1047-1054. Retrieved from http://dspace.ou.nl/bitstream/1820/1677/1/Themed%20Issue%20-%20Intro_2.pdf

Li, K., Amin, R., & Uvah, J. (2011). On synchronous distance teaching in a mathematics MS (Master of Science) program. *US-China Education Review A*(6), 761-767. Retrieved from http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=ED529432

Martin, F., & Parker, M. A. (2014). Use of synchronous virtual classrooms: Why, who, and how? *Journal of Online Learning and Teaching*, *10*(2), 192. Retrieved from http://jolt.merlot.org/vol10no2/martin_0614.pdf

Mayer, G. (2016). Small group work and whole group discussion mediated through web conferencing software. *International Journal for Scholarship of Technology Enhanced Learning*, *1*(1). Retrieved from http://ejournals.library.gatech.edu/ijsotel/index.php/ijsotel/article/view/12/11

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Morley, T., Usselman, M., Clark, R., Baker, N. (2009). *Calculus at a distance: bringing advanced mathematics to high school students through distance learning*. Paper presented at the ASEE 2009 Annual Conference & Exposition, Austin, TX.

Norberg, A. (2012). Blended learning and new education logistics in Northern Sweden. In D. G. Oblinger (Ed.), *Game changers: Education and information technologies* (pp. 327–330). Boulder, CO: EDUCAUSE

Pearson, C. (1998). The prediction of teacher autonomy. *Education Research Quarterly*, *22*(1), 33-46. Retrieved from http://eds.a.ebscohost.com.proxy-ms.researchport.umd.edu/eds/detail/detail?vid=4&sid=8a4756ca-bc10-4f17-961f-d9db27e07516%40sessionmgr4010&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=507664107&db=ofm

Philipp, S. B., Tretter, T., & Rich, C. V. (2016). Research and teaching: development of undergraduate teaching assistants as effective instructors in STEM courses. *Journal of College Science Teaching*, *45*(3). Retrieved from http://content.ebscohost.com/ContentServer.asp?T=P&P=AN&K=111934357&S=R&D=ehh&EbscoContent=dGJyMNLr40SeqLU4yOvsOLCmr0%2Bep65Ssqq4TbaWxWXS&ContentCustomer=dGJyMPGrs0u2q7FRuePfgeyx43zx

Power, M. (2008). The Emergence of a blended online learning environment. *MERLOT Journal of Online Learning and Teaching*, *4*(4), 503-514. Retrieved from http://jolt.merlot.org/vol4no4/power_1208.pdf

Power, M., & Vaughan, N. (2010). Redesigning online learning for graduate seminar delivery. *International Journal of E-Learning & Distance Education*, *24*(2). Retrieved from http://www.ijede.ca/index.php/jde/article/view/649

Retsinas, J. (1983). Teachers and professional autonomy. *Educational Forum*, *47*(1), 25-36. doi: 10.1080/00131728209335942

Reushle, S., &, Loche, B. (2008). Conducting a trial of web conferencing software: Why, how, and perceptions from the coalface. *Turkish Online Journal of Distance Education*, *9*(3). Retrieved from http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=5&sid=95efb97f-4903-41ed-8dfb-86920873e130%40sessionmgr4007

Robinson, W. S. (1951). The logical structure of analytic induction. *American Sociological Review, 16*(6), 812–818. Retrieved from http://www.jstor.org/stable/2087508

Roseth, C., Akcaoglu, M., & Zellner, A. (2013). Blending synchronous face-to-face and computer-supported cooperative learning in a hybrid doctoral seminar. *TechTrends*, *57*(3), 54-59. doi: 10.1007/s11528-013-0663-z

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68. Retrieved from http://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=4&sid=f7731745-7e6e-4923-8781-3588a5fc874b%40sessionmgr102

Shanker, A. (1985). The making of a profession. *American Educator: The Professional Journal of the American Federation of Teachers*, *9*(3), 10. Retrieved from https://eric.ed.gov/?id=EJ324717

Sheffield, S. S., McSweeney, J. M., & Panych, A. (2015). Exploring future teachers' awareness, competence, confidence, and attitudes regarding teaching online: Incorporating blended/online experience into the teaching and learning in higher education course for graduate students. *Canadian Journal of Higher Education, 45*(3), 1-14. Retrieved from http://search.proquest.com/docview/1779426600/fulltextPDF/C0788EAB1A0E4E72PQ/1?accountid=12557

Smith, M. K., Jones, F. H., Gilbert, S. L., & Wieman, C. E. (2013). The Classroom observation protocol for undergraduate STEM (COPUS): A New instrument to characterize university STEM classroom practices. *CBE-Life Sciences Education, 12*(4), 618-627. doi: 10.1187/cbe.13-08-0154

Stewart, A. R., Harlow, D. B., & DeBacco, K. (2011). Students' experience of synchronous learning in distributed environments. *Distance Education*, *32*(3), 357-381. doi: 10.1080/01587919.2011.610289

Swan, K., Shea, P., Fredericksen, E., Pickett, A., Pelz, W., & Maher, G. (2000). Building knowledge building communities: Consistency, contact and communication in the virtual classroom. *Journal of Educational Computing Research, 23*(4), 389-413. doi: 10.2190/W4G6-HY52-57P1-PPNE

Szeto, E., & Cheng, A. Y. (2016). Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students' social presence experience? *Interactive Learning Environments*, *24*(3), 487-503. doi: 10.1080/10494820.2014.881391

Utschig, T. T., Carnasciali, M., & Sullivan, C. S. (2014). Helping teaching assistants foster student-centered learning. *International Journal of Process Education, 6*(1), 3-20. Retrieved from http://processeducation.org/ijpe/2014/TAs.pdf

Webb, P. T. (2002). Teacher power: The exercise of professional autonomy in an era of strict accountability. *Teacher Development, 6*(1), 47-62. doi: 10.1080/13664530200200156

White, C. P., Ramirez, R., Smith, J. G., & Plonowski, L. (2010). Simultaneous delivery of a face-to-face course to on-campus and remote off-campus students. *TechTrends*, *54*(4), 34-40. doi: 10.1007/s11528-010-0418-z

Willig, C. (2013). *Introducing qualitative research in psychology*. London, England: Open University Press.

Dr. Mayer completed a Ph.D. in applied mathematics in 2008 at the University of Waterloo, Canada. Since then, Greg has held postdoctoral fellowships at The University of British Columbia and the Georgia Institute of Technology. In these positions, he developed and evaluated curriculum for distance and online courses in undergraduate mathematics. Dr. Mayer now works as an Academic Professional in the School of Mathematics at Georgia Tech, where he teaches undergraduate level courses, supports the development and delivery of distance education courses for advanced high school students, and conducts research on teaching and learning.

Dr. Sekayi earned a Ph.D. in the Social Foundations of Education with foci on qualitative research and the sociology of education from the State University of New York at Buffalo in 1996. Dia has held multiple full-time faculty positions, each with a focus on doctoral education. Dr. Sekayi joined Morgan State University as an Associate Professor in the School of Education and Urban Studies in 2016. She has published books, articles, and book chapters in the social foundations of education and has made local, national, and international presentations related to qualitative research.