Wong, L.-H. et al. (Eds.) (2013). Proceedings of the 21st International Conference on Computers in Education. Indonesia: Asia-Pacific Society for Computers in Education

A Model for Active Learning in Synchronous Remote Classrooms: Evidence from a Large-Scale Implementation

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Abstract: Teach 10000 Teachers is a project supported by the Government of India for training large numbers college instructors through distance education. The mode used is Synchronous Remote Classrooms (SRC), in which lectures are transmitted from a single location and participants attend them synchronously in their respective classrooms. In this paper we present a model for adapting well-known active learning (AL) strategies from face-to-face classrooms to the SRC mode, so as to enable effective learning. Our model identifies three levels of interactions – student-content, student-student and student-instructor – and then adapts these interactions to the SRC mode, using the affordances of the technology. We implemented this model with five AL strategies, in a 1-week workshop. We validated the model by examining participants' perception of the effectiveness of the AL strategies for their learning and engagement. We found that 86% of 1287 participants found our adapted AL strategies to be useful in learning. We also found that there is a high correlation (γ=0.75) between the perceptions of overall satisfaction and usefulness of AL strategies.

Keywords: Distance education, synchronous remote classroom, teacher training workshop, active learning, adaptation model

1. Introduction

Teach 10000 Teachers (T10KT) is an initiative under the National Mission of Education through Information and Communication Technology (NMEICT) of the Government of India. The goal of T10KT is to improve the quality of higher education faculty in the country through distance education workshops. The mode used is Synchronous Remote Classrooms (SRCs), in which lectures are transmitted from a single location and 50-100 participants attend them synchronously in their respective classrooms, located at 150-200 different geographic locations. Each classroom has a remote centre coordinator (RCC), who is trained to facilitate the instruction.

Due to the large scale of this program, it is important for workshop instructors to go beyond traditional lecturing and ensure that participants remain engaged. Several researchers have reported effectiveness of active learning (AL) strategies in distance education programmes (Koszalka & Ganesan, 2004; Jaffee, 1997). All have emphasized the need of adapting pedagogical practices to technology affordances, for effective learning. This need for adaptation arises while implementing active learning strategies in the SRC mode, since the set of affordances and constraints of this mode are different from the other modes.

In this paper, we present a model for adapting well-known active learning strategies from face-to-face classrooms to the SRC mode. The remote centre coordinator (RCC) and technology mediate the interaction between the instructor and the participants. In our model, the RCC plays the role of a proxy instructor, as well as an information transfer agent, while technology plays the role of enabling communication. We implemented this model using five active learning strategies – Think-Pair-Share, Classroom Voting, Pros-Cons Analysis, Peer Review and Muddy Points. We validated the effectiveness of our model by administered a survey to obtain participants' perceptions of the effectiveness of the active learning strategies. The survey contained questions on a Likert scale on participants' perceived learning and satisfaction, and on the facilitation provided by the RCC and technology. The results show that 86% of the 1287 participants found our adapted active learning strategies to be useful for their learning. We also found that there is a high and significant correlation (γ=0.75) between perceptions of overall satisfaction and usefulness of active learning strategies.

2. Related Work

The major modes of distance education (DE) include asynchronous, synchronous, blended and mixed modes of learning. Asynchronous mode facilitates the self-paced learner and permits different kinds of interaction, feedback and facilitation (Spiceland & Hawkins, 2002) through the internet. Synchronous learning happens when all the participants are virtually present at the same time even though they may be physically at different locations (Bernard, et al., 2009). Blended learning, which is becoming more common, accommodates the synchronous meetings through face-to-face (f2f) classrooms and online discussions as well as asynchronous activities (McGee & Reis, 2012). In a mixed-mode, there are no f2f interactions but there are good portions of synchronous and asynchronous modes of learning. An example of yet another mode was seen in The University of West Indies Distance Teaching Experiment (Kuboni, Thurab-Nkhosi, & Chen, 2013), which utilized an audio-conferencing facility linking several remote sites synchronously to support f2f instruction.

The key interactions or transactions in an educational environment happen between instructor, student and content (Shale and Garrison, 1990). A major challenge for a DE program is to reduce the transactional distance, identified as "a psychological and communications gap" (Moore, 2007), that is created in part due to the physical distance between learner and instructor. DE research has been unanimous about the need for more learner interaction (Bernard, et al., 2009; Jaffee, 1997). Arbaugh (2005) has reported that students perceived learning is affected by ease of interaction and instructors' emphasis on interaction. Anderson and Dron (2011), while tracking the evolution of DE, note that there has been a shift towards greater engagement of the learners in the more recent DE implementations.

Active learning in face-to-face classrooms encompasses several strategies designed to engage the learner in the learning process for providing the necessary learning outcomes (Prince, 2004). Active learning has been implemented in different distance education modes using different strategies. The strategy of instructional conversation in the synchronous discussion groups wherein the instructor and participants starts construction of a lesson based on participants' ideas and experiences is an established method of implementing AL in synchronous mode (Lara et. al., 2001). The blended learning mode offers several examples in terms of debates, case studies, group reports, interactive websites etc. to implement AL strategies (McGee & Reis, 2012).

DE programs in Asia have utilized technological solutions like e-learning and mobile based systems. A major drawback reported about Asian DE design is regarding the need for instruction designers to upgrade their knowledge of the selection and use of methods and media (Baggali & Belawati, 2009). Jagannath and Jobanputra (2011) do mention the possibilities of SRC mode within an earlier experience in India mentioning the need for structuring interactions for AL. The current study is one such attempt to address this problem. The SRC mode combines some features of synchronous delivery mode, with others of f2f classrooms, but it does not incorporate *all* necessary features to directly implement practices from either mode. Hence we need a model of adaptation of active learning strategies, considering the affordances and constraints of the SRC mode.

3. Model for Adapting Active Learning Strategies to SRC Mode

We created our model for adaptation of AL strategies to SRC mode using the following process. We first examined characteristics of AL strategies in f2f classroom mode. The three levels of interactions – student-content (S-C), student-student (S-S) and student-instructor (S-I) – are adapted to the SRC mode, using the affordances of the technology and incorporating mediation by the Remote Centre Coordinator (RCC). The S-C and S-S interactions do not have major changes in the SRC mode, but the S-I interaction has to be adapted to counter the transactional distance. We then categorize S-I interactions into three types: (i) Instructor directives, in which the instructor gives directions to students for performing an activity, (ii) Student responses, in which students respond to the instructor after completing the activity, and (iii) Discussion/Feedback in which the instructor gives feedback on students' responses and discusses the topic. Instructor directives are adapted by having the RCC play the role of proxy instructor within the local SRC and relaying the directives the students. Student responses are adapted by having the RCC play the role of proxy instructor to aggregate the responses and the role of information transfer agent to sends the aggregated response to the instructor. Discussions and feedback are adapted as a combination of the above.

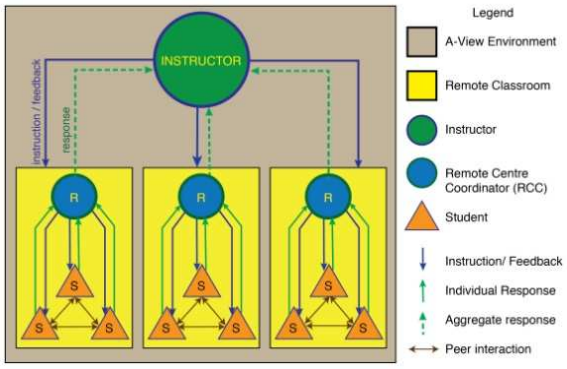

Figure 1: Our model for adapting AL strategies to SRC mode

These adaptations can be better understood with two examples of their usage within the workshop. First we see how the AL strategy of Think-Pair-Share (TPS) has been adapted within the SRC mode. Technology plays the role of facilitating information transfer (Grey background in Fig. 1). In the Think phase, the RCC plays the role of information transfer agent to convey the instructor's directives and the role of the proxy instructor to implement the instructor directives (downward blue arrows in Fig. 1). In the Pair phase, the RCC performs the role of proxy instructor to ensure student-student interaction (horizontal brown arrows in Fig. 1). In the Share phase, the RCC performs the role of proxy instructor to collect student responses and aggregate them, and the role of information transfer agent to convey the aggregated response to the instructor for subsequent discussion (upward green arrows in Fig. 1).We note that the actions in each phase of the TPS in our adaptation remain the same as those in a single face-to-face classroom. Hence despite an increase in the physical distance between the learners and the instructor, our model of adapting AL strategies to SRC mode helps mitigate the transactional distance.

Similarly consider the strategy of peer review, used for increasing collaboration and providing formative assessment. In a small f2f class, the instructor initially poses the problem which is solved by students. Then, they review each other's solution and report back to instructor. In the SRC adaptation, the instructor first poses the problem to student (Blue), and provides necessary guidelines to solve it. The RCC now plays the role of the proxy instructor (Blue) and ensures that the participants in his/her SRC work on solving the problem. The participants then perform the peer-review process within each SRC (Brown). The RCC is then instructed to collect, aggregate and send the queries to the instructor, via chat (Green).The instructor addresses these queries and responds to the entire class when needed.

Note that in each of the above adaptations, as far as a student is concerned, the steps remain the same as the original strategy in a f2f class. Hence we believe that our adaptation model would have the same effectiveness for a student, as that of a single classroom implementation. We have validated the effectiveness of our model through student perceptions, as explained in the next sections.

4. Implementation of the Model

We implemented our model for adapting AL strategies to SRC mode in a two-day workshop on 'Research Methods in Educational Technology'. The participants of the workshop, corresponding to the 'students' in our model, were 5094 in-service college-level instructors, across 204 SRCs. The goal of the workshop was to train the participants to plan and conduct educational technology studies, starting from identifying the components in educational research, to positioning their ideas based on analysis of existing literature, to designing rigorous experiments to validate their ideas. The workshop was held on two consecutive Saturdays, to take into account the availability of participants.

The workshop consisted of both synchronous and asynchronous modes of interaction. A video conferencing application, A-VIEW (A-VIEW, 2013) was used for the synchronous interaction. The RCC facilitated the synchronous interaction, by playing the dual role of proxy instructor and information transfer agent, as described earlier. Prior to the workshop, the RCCs had received training about their roles. The asynchronous interaction was facilitated using Moodle and participants were asked to engage in off-line discussions and submit assignments.

The diversity in multiple dimensions – geographic location, cultural background, engineering domain, age and experience – added to the challenges in designing the instruction and treatment, over and above the SRC mode. We chose five AL strategies – Think-Pair-Share, Classroom Voting, Pros-Cons Analysis, Peer Review and Muddy Points. Their choice was based on the instructional goals

of the workshop. For example, Pros and Cons Analysis was chosen because participants need to be trained to critically analyze and evaluate existing literature, for positioning their own work.

5. Validation of Model

We investigated the effectiveness of the model in terms of participants' perceptions of their learning and engagement from the workshop which was implemented based on our adaptation model of active learning strategies. We administered a survey questionnaire to determine participants' perceptions. As mentioned in the Introduction, our research questions are:

RQ1: What are participants' perceptions of the usefulness of the active learning strategies for their learning?

RQ2: How do participants' perceptions of the usefulness of active learning strategies affect their overall satisfaction?

RQ3: How do the mediators of student-instructor interaction, that is, RCC and technology, affect participants' perceptions of the usefulness of the active learning strategies?

The research design that was used to answer the above questions had the following features:

Sample: A total of 5094 participants had registered from across 204 Remote Centres for the workshop. Of these, 2778 participants were present for all sessions, among which 1484 filled out responses to the survey. The sample for this study consists of 1287 participants who consented to participate in our research. All participants were instructors in colleges from different parts of India. Majority of participants had post-graduation (Masters Degree) in their respective domains.

Instruments. A survey questionnaire was administered on the participants at the end of second day through Moodle, to understand their perceptions on the various aspects of the workshop. The survey questionnaire contained 18 questions on a 5 point Likert scale (From Strongly Disagree to Strongly Agree). These items were categorized based on constructs of medium, synchronous mode strategy, satisfaction and learning, which were related to different aspects of the workshop. An example of an item from the construct 'synchronous mode strategy' includes: "The session on 'Addressing the Common Queries' from Chat/Discussion forums was useful", which specifically looked into the adaptation of the active learning strategy Muddy Points. Another example is the item "I found the activities such as 'Think-Pair-Share' and 'Voting' helpful for improving my understanding of concepts learnt". An example of an item that addressed participants' perception of overall learning was, "As a result of the workshop, I feel confident of tackling educational technology research problems".

Analysis. We first grouped the survey responses based on the construct that they address. We analyzed the data by calculating the response frequencies of participants' perceptions of the different active learning strategies (RQ1). To determine how the perceptions of the usefulness of AL strategies affect overall satisfaction (RQ2) and how the mediators RCC and Technology affect perceptions of usefulness (RQ3) we calculated a rank correlation. As the responses were limited to the 5 point Likert scale, we use the gamma correlation coefficient, which is used when working with ordinal level data that is ranked in a small number of response categories. The gamma statistic is designed to determine how effectively a researcher can use information about an individual's ranking on one variable to predict that individuals ranking on the other. We calculated the correlation between the responses to the mediators of student-instructor interaction - Technology and RCC – with the responses on the usefulness of active learning strategy and overall satisfaction.

6. Results

Figure 2 shows the frequency of responses on survey questions which looked into the perception of participants in terms of their overall learning and satisfaction. In terms of overall learning (N=1287), 283 participants strongly agreed and another 823 agreed that workshop has had positive impact on their learning. While 158 remained neutral on this, a small minority of 23 people did not believe that their learning was improved (Disagree – 17 and Strongly Disagree - 6). In terms of overall satisfaction, 432 participants strongly agreed, 774 agreed and 62 remained neutral towards the question on overall satisfaction. Here also there was a very small fraction (Disagree – 7, Strongly Disagree – 12) of participants who did not hold similar views on satisfaction with this workshop.

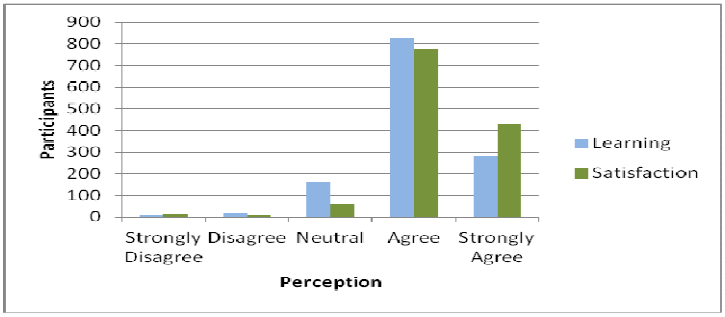

Figure 2: Participants perception of Learning and Satisfaction

Table 1 shows the number (percentage) of responses to individual active learning strategies. We note that a majority of participants - 87% average over all strategies - agreed or strongly agreed that active learning strategies were useful for their learning.

Table 1: Frequency of participants' response on usefulness of AL strategy

AL strategy	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TPS & Voting	19 (1.5%)	15 (1.2%)	99 (7.7%)	835 (64.9%)	319 (24.8%)
Pros-cons	17 (1.3%)	12 (0.9%)	89 (6.9%)	687 (53.4%)	482 (37.5%)
Muddy Points	44 (3.4%)	24 (1.9%)	174 (13.5%)	827 (64.3%)	218 (16.9%)
Peer Review	7 (0.5%)	15 (1.2%)	156 (12.1%)	823 (63.9%)	286 (22.2%)

To determine if participants' overall satisfaction was related to either the effectiveness of the active learning strategies (RQ2) or to other variables like technology and RCC (RQ3), we calculated the rank correlation between these variables. It can be seen from Table 2 that, there is a high of correlation between overall satisfaction and all these variables. The values for correlation coefficient (γ) of usefulness of active learning strategies were found to be 0.75, and that of learning environment within RC and facilitation by RCC were 0.536 and 0.501. All these correlation coefficient are highly statistically significant ($p<0.001$). The correlation with facilitation by technology was 0.354.

Table 2: Correlation between overall satisfaction and other variables

γ (N=1287)	AL strategy usefulness	Conducive Learning Environment	Facilitation by RCC	Facilitation by Technology
Overall Satisfaction	0.75	0.536	0.501	0.354

Also the correlation between the participants perception of usefulness of individual active learning strategy to the mediating variable of RCC facilitation was found to be generally near to or above the significant figure of 0.300 while that of technology was always found to be less than 0.300.

7. Discussion and Conclusion

Our research questions focused on the participants' perceptions of the usefulness of AL strategies (RQ1) and their effect on overall satisfaction (RQ2). Based on the results (Fig. 2) we infer that AL strategies are effective for learning in a distance mode program, thereby reconfirming known results (Prince, 2004). The positive responses to the survey questions and their strong correlation (Table 1) indicate that the effective implementation of Active Learning strategies had a strong impact on overall satisfaction of the workshop. Our third research question was how the RCC and technology, which are the mediators of student-instructor interaction, affect participants' perceptions of the usefulness of the active learning strategies. Based on Table 1, we can infer that the impact of RCC's facilitation has had a major impact on the participants' perception of learning and satisfaction compared to that of technology. We infer that technology is important, but plays a secondary role, that of facilitating instructor-student transactions across geographical distance.

The study has provided an easy adaptation model for both the instructor and RCC, to implement active learning strategies in an SRC mode. The amount of RCC training required to make this model work is also significantly less. The effectiveness of the strategy in terms of participant satisfaction has already been shown above. The key to this model is that it does not change the face-to-face implementation of the active learning strategy in terms of its student-student or student-content interaction; rather it uses the affordances available within the SRC mode to implement the student-instructor interactions effectively. Thus from a student's perspective, there is no difference in the AL strategy adapted to the SRC mode, compared with the corresponding f2f implementation.

The two major affordances used within the model are technology and the Remote Centre Coordinator. Technology is used to facilitate information transfer between participants and instructor. The role of RCC is crucial as he/she has the dual role of information transfer agent as well as proxy instructor within each Remote Centre. The model we proposed prescribes how the student-instructor interaction from a f2f active learning strategy is to be implemented based on whether this interaction falls into the category of 'information transfer' (such as collecting responses) or 'proxy instructor' (such as the facilitating a student-student discussion). We have shown how the model can be implemented for five different active learning strategies. We believe that the proposed model can be applied to adapting other active learning strategies in SRC mode by classifying the student-instructor interaction in the strategy into either of the above categories. Other universities or agencies implementing courses and workshops in SRC mode can use our model to adapt active learning strategies. As a follow-up, we intend to conduct further validation of the model, by investigating the leaning gains of the participants.

Acknowledgement

This work was supported by the National Mission on Education through ICT (NMEICT) project of MHRD, Government of India.

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