“I want YOU to answer!”

An exploratory study of cold-calling methods to increase engagement in online classes at school

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Abstract

Cold-calling refers to nominating a student to speak up even if their hand was not raised or they did not volunteer to participate. Sometimes, due to performance anxiety, fear of negative judgement and overall negative emotional response to cold-calling, students resolve to maladaptive coping strategies like escape and this behaviour increases in an online environment. The aim of this research was to propose design interventions for cold-calling in an online class and assess their effect on students' psychological and emotional engagement involving willingness to participate, positive emotional response, perceived choice, perceived competence and relatedness. The design was tested with sixteen seventh grade students in a History class and evaluated using Intrinsic Motivation Inventory (IMI) and qualitative data from semi-structured interviews. The results indicate a significant increase in the overall psychological and emotional engagement. Design recommendations are made for cold-calling in an online class that include externalizing the locus of control to a personified virtual tool, including positive stressors like encouragement and cheering and promoting adaptive coping strategies to stress like support seeking and information seeking.

Keywords: Cold-calling, online education, psychological engagement, design based research, interaction design

1. Introduction

An online class or a physical class, to make them more interactive and to make sure that students are attentive, the teacher often cold-calls students to participate involuntarily. Cold-calling refers to nominating a student to speak up even if their hand was not raised or they did not volunteer to participate. However, as a lot of teachers have suddenly shifted to online classes, there is less feedback and no control to know if the students are paying attention or understanding what is being taught [1]. In such a scenario, cold-calling is one of the methods to engage students and check on them [2]. While there are some teachers who do not prefer this practice, it is an excellent way to increase class discussion, help the teacher to check student's attentiveness and learning, and even increase the students' comfort level and confidence while participating, over time [3]. However, some students could initially feel stress, performance anxiety, and an overall negative emotional response when cold-called to answer and they resolve to maladaptive coping strategies like escaping (not attending classes/discussions) which hampers their learning [5]. In an online class, it is especially easier to escape and dodge questions as there is less control over students.

There has been a lot of research advocating active learning practices especially for online or blended learning environments [6]. Most of these

are quite dated for example the most recent and cited research on the positive impact of cold-calling is from 2013 [3]. However there is room for improvement [10]. In the recent times of COVID 19, forced shift to online learning and increased awareness on mental health has led to some work looking more closely at the challenges with active learning especially on psychological factors like cognition and emotion [1][2][5]. This work is a Design Based Research (DBR) [7] that adds another small drop to the ocean of such recent studies. While there exists enough theoretical research from the past on psychological engagement, [8] dealing with intrinsic motivation [9] in class, this paper aims to empirically study some original design interventions through a self developed online tool called Edus to improve the cold calling approaches in an online class.

The following research objectives guide the research:
1. To propose design interventions based on existing frameworks to solve challenges with cold calling in an online class.
2. Assess the effect of different interventions on school students' psychological and emotional response to cold-calling in a real world online class.

2. Review of Literature

2.1 Cold-calling for engagement

Dallimore et al. [18] conducted a study to examine an environment which uses cold calling and graded participation to include more students in discussions. Their findings reveal that this environment was positively related to participation frequency, students' preparation and comfort over time. The students who were initially comfortable with cold-calling maintained their participation frequency and comfort level. Students who had low liking for cold-calling, showed a linear growth over time. Dallimore et al. [3] conducted a follow-up study to observe the effect of cold-calling on voluntary participation. It demonstrated that cold-calling not only enforces involuntary participation but also affects voluntary participation. Again, the number of students participating voluntarily in a cold-calling environment increased over time. The self-reported comfort level of these students also increased over time.

The study also ends by discussing that with increasing emphasis on the development and delivery of online courses, future research might examine the form cold-calling might take in an online learning environment. For example, such research might examine strategies for engaging less willing participants

2.2 Stress and anxiety with cold-call

Cooper et al. [4] investigate students' emotional response for different types of active learning. For cold-calling, students reported fear of negative evaluation as their primary reason for anxiety. While students seemed to recognize that instructors likely practice cold call or random call to enhance their learning, they felt as though the anxiety associated with the anticipation of speaking out in front of others negatively impacted their learning and performance. One student in this study states that ": "My brain stops. [If the instructor] asks me a question, I have no idea what the answer is"

Brigati et. al. [5] takes the topic further by investigating different coping mechanisms used by students. It was observed that despite anxiety and stress, the students mostly used adaptive coping strategies like information seeking, support seeking and self reliance. For volunteering to answer a question, however, they used maladaptive strategies like escape. Even though students in the study did not escape a cold-call even if they were anxious and stressed, the study proposes that some students may not be very good with such adaptive strategies and may need to be taught or made aware of such options like support seeking, information seeking instead of escaping.

2.3 Engagement

There is no unified definition of student engagement as a whole but its different components are often discussed critically. The widely accepted three-component model often consists of behavioral, emotional, and cognitive engagement [11].

Behavioral engagement is more about the quantity. It talks about the amount of time spent in online discussions [12], the number of posts or messages written and posted [13] and also the amount of time spent in composing those posts. It does not deal with the quality of the time or posts or the feelings of students and their psychological and emotional response to these.

The next type of engagement is emotional engagement that measures how positively a student responds or shows appreciation [17].

Cognitive engagement is further divided into two parts- cognitive (or strategic) and psychological [21]. The psychological aspect talks about a student's willingness to improve [8] and about intrinsic motivation [14] to spend extra time and effort learning. The strategic learning part focuses on the student's ability to reason, think critically, argue, and understand [15]

Connell and Wellborn [16] talk about an individual's psychological need for autonomy, relatedness, and competence. Catering to these needs in a learning environment leads to better engagement. Autonomy is about choice and shared decision making. Relatedness is about having a supportive and encouraging environment. Competence is about knowing where you stand on the path of your goal.

2.4 Conclusion and direction for research

From the above discussion, we may say that cold-calling could be a sure-shot way to increase behavioural engagement as frequency of participation, both voluntary and involuntary, increases [18]. However, there seem to be some gray areas regarding the psychological and emotional effect of cold-calling. As Cooper et al. have pointed out that students' emotional response could be negative [4] and Brigati et al. reveal that even if students may want to escape volunteering to answer questions [5]. Relating their finding further discussions on engagement we may say the students are not willing to participate (low psychological engagement) but may do so due to no choice (less autonomy) or unable to go for adaptive coping strategies like support seeking while fearing negative evaluation (low relatedness). Even Dallimore et al. point towards examining strategies to engage less willing participants. There is also a gap in the literature to study the effect of cold calling on school students. Hence, this paper aims to explore the effect of an online tool designed for better psychological and emotional engagement on seventh grade school students.

3. Design Intervention

A design intervention [24] was done to explore and assess the effect of different ways of cold-calling in an online class, that aim to :

1. Trying to meet students' need for engagement- autonomy, relatedness, competence, while cold-calling
2. Promoting adaptive coping strategies like support seeking and information seeking instead of maladaptive practice like escaping
3. Having positive emotional response by having an environment of support, encouragement and some light-hearted elements of fun

3.1 External locus of autonomy and more relatedness to teacher

The tool features a mascot that does the job of asking questions in the middle and nominating students to answer (fig. 1). The aim is to externalize

the locus of control in the teacher-student relation by giving the authoritative powers to a virtual tool. The teacher in this case is to teach and support and not someone to fear which is important for more relatedness in the classroom. The fear of mascots is reduced due to its cute and fun cartoonish appearance [22] and virtual/ non-physical presence leading to more positive emotional response and engagement [22].

3.2 Cheering and celebration for positive emotional response

The nomination or cold-calling of students is made more cheering than cold with a tone of anticipation and celebration to it. Using the virtual medium further, we have the mascot ignite a question bomb that goes off with colorful confettis while announcing the name of a student. The aim is to build some energy with the bomb ticking but release it with a positive celebration feel instead of an harmful explosion (fig. 2 and 3). Cheering and welcoming sounds accompany. Thus, the bomb maintains some arousal level in accordance with Yerkes-Dodson [23] effect but using encouragement and cheering (positive) instead of threat or fear of punishment (negative).

3.3 Random calling for impartiality but enjoyment

One of the things that works for cold-calling is the anticipation and the fact that students have to be alert. The tool shuffles through all the names as the bomb is ticking and lands on one random name as the bomb goes off to celebrate sounds and confetti. This adds a gamified lottery feel and it is random and impartial.

3.4 Perception cloud for better relatability and less judgement

After a random student's name is displayed, a cloudy speech bubble pops

Figure 1. Meet Edus mascot

Figure 2. Nominating by igniting

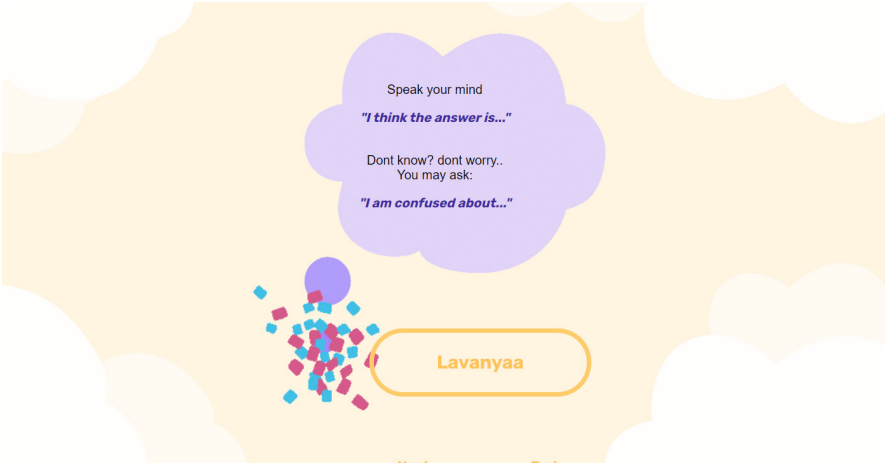

Figure 3. Revealing the name with confetti and sound

Figure 4. Perception cloud with prompts

up with text- speak your mind "I am thinking…". This is to signify that no rigid answer is expected from the students (fig. 4). They can just talk about and articulate their learnings, whatever is in their head.

3.5 Sense of choice for more autonomy and support seeking

Along with the speech bubble "I think.." prompt, there is also the option of- Don't know the answer? Don't worry, you may ask "I am confused about.." or "I want to clarify…" (fig. 4). This is to make the adaptive practice of support seeking more apparent to everyone and to give them some choice.

3.6 Feedback and learning for encouragement and support

After a few rounds of answers by the students, the teacher can end the discussion with their note. A similar speech bubble animation pops up with prompts "I appreciate…", "I want to clarify…". The aim is to acknowledge student's participation while clearing any misconception. Students need to be given positive feedback for speaking up to reduce the fear of negative evaluation.

3.7 Take-away points for aligning with learning goals

Building on the previous point, the lecture ends with students articulating some take-away points with the help of some prompts "The most interesting thing was…", "I am still wondering about…", "A question I have…", etc. The aim is to focus on the learning at the end of the discussion instead of how many right or wrong answers given.

The prompts/ sentence starters at all stages help to articulate or give a direction to thinking.

4. Method

4.1 Research framework

An exploratory mixed method study [19] was used in the current study with more emphasis on qualitative methods. The quantitative portion includes data from 10 self-reported questionnaires taken from the Intrinsic Motivation Inventory (IMI) [20]. IMI contains statements to determine enjoyment, perceived competence, pressure/ tension, perceived choice (autonomy), relatedness. These can be rated on a 7 point likert scale (from 1 “not true at all” to 7 “very true”). IMI was chosen as the components evaluated in IMI align with our goal to increase psychological and emotional engagement. The qualitative part consists of insights from interviews with the participants to know more about their experience and also investigate their response in IMI indepth. To make sure that any positive result was because of the design intervention itself, two scenarios were tested with the same group- one without any design intervention (regular class) and one with the design intervention implemented.

4.2 Participants

The study was conducted in an online class of sixteen 7th grade students at Amity International School, Lucknow. History class was chosen due its descriptive nature that allows more open discussion along with testing memory retention of facts leading to more cold-calling from time to time. Seven of the sixteen participants were male and nine were female. The participants were selected through convenience sampling, which is that the researcher selects participants based on their accessibility and proximity. Prior permission was taken by the Principal, the teacher and parents through an online consent form. They were informed about the procedure and that this is a non-compensatory volunteer expt with low to no risk. Further, assent of the students was taken.

4.3 Procedure

Firstly, students’ pre-test response was taken to the IMI after a conventional class (NO design intervention) involving cold-calling. Next, a post-test response of the same group was taken after a 1 class using Edus. The mean score of the same group was compared in both the scenarios (without intervention and with intervention) to check for any increase. Lastly, brief semi-structured interviews were conducted with the students to further examine their experience and assess their subjective emotional response.

4.4 Data analysis

Self-reported scores from the IMI questionnaire are summarised using descriptive statistics, showing the central tendency (mean) and spread (standard deviation) in students’ response. As the low sample size (n=16) limits the generalizability of the result, we mostly rely on descriptive statistics and qualitative assessment. However, a paired t-test was done at the end to check for any statistical significance even in the small sample. The data from the interview was analysed to identify recurring themes, gain insights and support the self-reported quantitative data.

5. Results

There was a slight increase in the self reported psychological engagement from the scenario 1- conventional class ($M = 5.58$, $SD = 0.81$) to the scenario 2 with the design intervention ($M = 6.04$, $SD = 0.55$). Mostly students (n=15) reported having fun with the interactions with Edus. Many students (n=12) reported they wished that their name showed up on the screen more often.

	Scenario 1		Scenario 2	
	Mean	**SD**	**Mean**	**SD**
Overall score	5.26	1.89	5.66	1.46
Interest/ Enjoyment	6.38	1.25	6.85	0.35
Perceived Competence	5.25	1.96	5.88	1.36
Pressure/ tension	5.71	1.73	5.79	1.49
Perceived Choice	3.56	2.58	4.36	2.06
Relatedness	5.43	2.1	6.31	1.66
Mean from self-report IMI likert scale of **7**				

Table 1. Result from IMI scores

As the questionnaire contained questions related to interest/ enjoyment, perceived competence, pressure/ tension, perceived choice and relatedness, here are the results for each part (table 1).

5.1 Effect on interest/enjoyment

The mean score for interest/ enjoyment rose from M = 6.38 (SD = 1.25) in scenario 1 to M = 6.85 (SD = 0.35) in scenario 2 with the design intervention. In this case, students already found their teacher and class interesting hence the high mean score in control study. However, the interest/ enjoyment while using the tool Edus was almost close to a maximum of 7 and with much less deviation in response.

Overall, almost all students said they found Edus fun (n=15) and even funny (n=1). They liked the mascot coming in between the slides and asking questions and claimed that they enjoyed answering questions and learning (n=7). As one student said,

> *"Yes, Because it's really interesting and it's really fun to answer the questions that Edus asks us." and "It was very fun. In between the ppt after a few slides we used to get a question by Edus and we need to answer it."*

Students liked to see the "funny" mascot asking questions in between the slides and perceived it as a fun break from the lecture.

Students also liked their name being called with the confetti and sounds (n=12). It made them wish that their name would pop up.

> *"Sound was good , I was attracted to it , I was not bored at all and I love it..."*

Some people whose name did not show up wished that it did (n=3),

> *"It was fun..though Edus never took my name but i hope so in future".*

5.2 Effect on perceived competence

The mean score for perceived competence increased from M = 5.25 (SD = 1.96) in the first scenario of conventional class to M = 5.88 (SD = 1.36) in the second scenario with the design intervention.

Perceived competence is the students' perception of how much they are learning and getting better moving towards their learning goals. Students felt like they were learning and that the tool helped (n=11). They perceived the questions to be for their own learning and understanding. A student said when asked if they would like to continue using Edus,

> *"Yess. because it helps me in understanding and making the lecture more interesting",*

5.3 Effect on pressure/tension

The mean score for pressure/tension went from M = 5.71 (SD = 1.73) in the first scenario of conventional class to M = 5.79 (SD = 1.49) in the second scenario with the design intervention. As this was still a cold calling environment, tension/ pressure was not completely diluted by the tool. Students still felt tensed by the randomness of the tool and the fact that anyone could be called (just like a control cold-calling environment). However, due to more enjoyment, perceived competence, autonomy and

relatedness, the overall psychological engagement and students willingness to use the tool is much better. As one student says,

> "*Whenever it would show/land on my name I did get tense but the experience was amazing*".

And another illustratively explains,

> "*At first I was not so confident to answer the questions and I thought that I could be wrong and all.. but after ma'am explained the chapter I thought that 'I guess it's not that hard' so that's why I started answering. Edus's question are really good and but I didn't even know all the answers but it was still very interesting.*"

There were still some students (n=2) who felt that Edus took away some of the tensed atmosphere of the class.

5.4 Effect on perceived choice

The mean score for perceived choice (autonomy) increased from M = 3.58 (SD = 2.58) in the first scenario of conventional class to M = 4.38 (SD = 2.06) in the second scenario with the design intervention.

Again, in a cold-calling environment which demands involuntary participation, the choice or autonomy is extremely low. However, this time the tool could give them some choice if they did not know the answer, to seek support. This encourages the adaptive coping strategy instead of just escaping. The perception cloud helped students to speak something even if they were not sure of the answer (n=7) and some actually asked for support like hints and explanations (n=2) as demonstrated by the user statement in the previous section 5.3. This behaviour was not observed in the first scenario without the design intervention, where some students had gone silent or blank when asked to answer a question (n=3).

5.5 Effect on relatedness

The mean score for relatedness increased from M = 5.44 (SD = 2.10) in the first scenario of conventional class to M = 6.31 (SD = 1.66) in the second scenario with the design intervention.

Reducing control of the teacher and introducing the virtual mascot helped increase the relatability as students perceived the environment to be more fair and believed that everybody could be given a chance (n=11). A student says,

> "*I really liked Edus because while as teachers can select any child they want and it is not random so that's not fair while Edus removed that possibility.*"

Apart from this, it also increased relatedness as students could seek support from the teacher.

5.5 Overall effect and statistical significance

The mean score of the whole IMI self-report questionnaire increased from M = 5.58 (SD = 0.81) to M = 6.01 (SD = 0.55) with the design intervention. Upon doing a paired t-test to study increase in individual student score in two scenarios along with the overall increase, the two-tailed p-value of 0.0178 was obtained through google sheets [25]. By conventional standard, where p value must be > 0.05, this is considered statistically significant. Despite this, the low sample size limits the overall generalizability of the results. More study could be done with a larger sample of the target population for better inferential statistics and hence better generalizability of results. For this small study, however, the results are in the correct direction.

6. Discussion

The aim of this research was to propose design interventions for cold-calling in an online class and assess their effect on students' psychological and emotional engagement (involving willingness to participate, positive emotional response, perceived choice, competence and relatedness) evaluated by IMI and qualitative data from semi-structured interview. This was done to solve certain challenges with cold-calling such as stress, fear of negative evaluation, and maladaptive coping strategies like escaping online discussions.

The results indicate a significant increase in the overall psychological and emotional engagement and its various components as evaluated through IMI mean score and t-test. The improvement could mostly be affected by the components of enjoyment/ interest, which was rated almost to the highest score of 7, along with the component of relatedness (that deals with having a supportive and encouraging environment). There was a general pattern of low perceived choice in both the scenarios as cold-calling is about involuntary participation, leaving less room for autonomy. There was also no effect on the component of pressure/ tension with the design intervention.

The improvement in enjoyment/ interest could be credited to the personification of the virtual tool. It was neither perceived as an emotionless software nor as a strict teacher cold-calling students. It was perceived as "fun" interactive breaks in between the lecture by a third party intervention that was perceived to be "funny". This externalization of the locus also led to the tool being more "fair" and randomness helped students be alert without any negative emotions for the teacher. Thus, leading to more relatedness as the students reached out to the teacher to ask for support like hints, and more explanation.

Students seeking support or giving some answers despite not being sure instead of escaping or going silent could also be credited to the perception cloud design with different prompts like "I think the answer is.." or " I am confused about..." that gives some choice to students to seek support or speak their mind. As this was not observed in the conventional class where 3 students reported going totally silent when a question was asked, this may have led to more relatedness and also some perceived choice if one does not know the answer.

As there was still some pressure/ tension, it could be due to the bomb, random nomination and the spotlight. The aim in the design intervention was to maintain some arousal according to Yerkes-Dodson law but have a positive undertone of cheer and encouragement instead of fear. This was confirmed in a few responses where students admitted feeling tensed when their name showed up but claimed that the overall "experience was amazing". However, there could be some further intervention to see the effect of a more relaxed environment where students are given slightly more control. For example, students could be given the control to pass the bomb to the next random person before it goes-off or keep it with them if they want to answer. This may create a placebo effect of autonomy but may promote escape behaviour. Instead of the bomb, some other more neutral artefacts could be used as well. Although some arousal or stress was maintained in the intervention, we did not study the effects of it on learning or performance. Therefore, future work may also study the effect of different ways to nominate and different amounts of control on stress as well as its relation to learning or performance.

Despite not studying the effect of the tool on actual learning, the assessment for perceived competence revealed that students did perceive to have learnt more through Edus. This could be due to its emphasis on learning and take-away points instead of just points/ scores based on right or wrong answers that increase performance anxiety. Again as the tool was not really tested in comparison to another tool that uses points/ scores and emphasizes on performance, future work may conduct such A/B testing.

Another clear limitation of this study is the sample size. Only sixteen students were enrolled, which limits the generalizability of the results. Although the goal of the current study only focuses on the exploratory step of using certain interventions in cold-calling, and descriptive statistics have been provided and a paired t-test on the overall IMI score shows a significant improvement. These findings could still be limited. Also, like previous research on cold-calling, we have not studied the effect over time.

7. Conclusion

The paper explores and assesses some original design interventions to increase psychological and emotional engagement in a cold-calling environment in an online class. There were some conclusions that can be made which can be incorporated while designing online tools for discussion through cold-calling. Following are some design recommendations contributed by the quantitative and qualitative analysis in the study-

1. Mediating nomination of random students using a virtual tool that could be personified for the students to relate with, at the same time having the teacher by the side to teach and support and not cold-call. Thus, externalizing the locus while maintaining relatedness

2. Giving a clear option to students to seek support or seek information if they do not know the answer to reduce fear of negative evaluation and maladaptive coping strategies like escape.

3. Include positive stressors, if any, like to encourage and cheer for students instead of negative stressors like threat or punishment. This will lead to an overall positive emotional response even if they feel a bit tense initially. (the effects of having no stressors and a completely neutral environment are not explored)

4. Provide prompts and sentence starters to help articulate thoughts so that students don't go completely silent or blank due to stress.

5. Help articulate learning and take-away points to remove emphasis from right or wrong answers. (whether or not to have accompanying performance points or scores is not explored)

All in all, the exploratory study was able to provide some concrete ideas for better emotional and psychological engagement while cold-calling in online class. It also opens room for more discussion and research on the effects of variations of such concrete ideas on stress and also the ultimate effect on learning itself. We also need to explore the emphasis on learning vs performance in a concrete way, evaluating different points, scores and other feedback systems. Catering to emotional and psychological needs and identifying concrete steps to designing such an environment is just as important as designing for cognitive and behavioral needs.

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