

Comparing Boredom Proneness in Traditional and Virtual English Classes

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Abstract: Positive emotions are increasingly being studied in the acquisition and teaching of second or foreign languages. Still, negative emotions are also present all the time and need to be given attention. This paper focuses on boredom, a concept that has been studied in educational psychology but has received little consideration from academics studying foreign language learning. The present study aimed to compare the amount of boredom experienced in traditional to that of the virtual classrooms. To obtain the research objective, a quantitative non-experimental research approach was chosen, including a survey design. The translated version of the Boredom Proneness Scale (BPS) was used to collect data from the participants. This study was conducted with 120 female high school students, divided into two 60-member groups. One group was instructed to answer the items for the traditional classroom, while the second group was instructed to answer the items for the virtual one. An independent t-test was implemented, and the results indicated that the two groups experienced approximately the same level of boredom, with the traditional class scoring slightly higher. However, this difference was not statistically significant. Lessons for teachers and teacher educators are discussed in light of the findings in order to enhance both traditional and online English instruction.

Keywords: Boredom, Boredom Proneness, Traditional Classes, Virtual Classes

Introduction

The concept of boredom has drawn a lot of research attention in psychology and educational psychology over the past three decades. Still, it yet to be taken seriously and is, therefore, an unexplored topic in second/foreign language (L2/FL) learning and instruction. Boredom, which is characterized as an emotional or psychological condition, is a feeling of emptiness that people experience when they are unable to find meaning or purpose in their life. More comprehensively, boredom proneness is defined by Boden (2009) as a personality feature associated with cognitive, attentional, and neuropsychological concepts related to an individual lack of ability or a desire to draw attention to special tasks in the environment. Many instructors typically attribute boredom to students' anxiety, depression, personality, or only laziness and, therefore, overlook it (Kruk & Zawodniak, 2018). Bored students typically feel indifferent, discouraged, uninterested, annoyed and/or unsatisfied with their surroundings because they believe them to be uninteresting and boring, but they are also hesitant to make a positive effort to change this situation (Eastwood et al., 2007). The quality of student learning, achievement, and social connections are all negatively impacted by boredom because it is one of the most often experienced academic emotions (Pekrun et al., 2010). It is a negative feeling that has a higher impact on the learning process than positive

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emotions like enjoyment and pride, along with wrath, worry, helplessness, and shame (Forgas, 2013; Sansone & Thoman, 2005). Additionally, it has been linked to impulsivity, risk-taking, less self-regulated learning, and decreased motivation in learners (Daschmann et al., 2011; Preckel et al., 2010). Anxiety and boredom have been found to have almost equal effects on academic performance (Tze et al., 2013). Because bored learners are disengaged from schoolwork or other activities, they are less motivated, which affects their ability to focus or just show interest and joy (Pekrun & Linnenbrink-Garcia, 2012).

Boredom is a frequent emotion experienced in foreign and second language classrooms, though less empirical attention has been paid to it compared to other learner variables (Pawlak et al., 2020). Over the last few years, research on boredom has experienced continuous growth, as more attention has been directed toward boredom in varying contexts (Vodanovich & Watt, 2016). One reason for this might be that boredom is such a common feeling and that it is especially experienced in classroom settings (Vogel-Walcutt et al., 2012). However, unlike other emotions, including test anxiety, very little research has been done on boredom in the classroom, despite its negative effects on learning (Vogel-Walcutt et al., 2012). Due to the prevalence of boredom in academic contexts and the rather sparse research on boredom in academic contexts, it seems necessary to conduct more research to gain better insights into boredom in the classroom. Even though students usually experience boredom in traditional classrooms (Daschmann et al., 2011; Mann & Robinson, 2009) and related literature on boredom confirms the claim that boredom is a negative and deactivating emotion in school classrooms (Vogel-Walcutt et al., 2012), less experimental research has investigated the association of boredom and virtual classrooms. The goal of the current study is to fill in this gap by examining the following research question:

Research Question One: Are there any significant differences between traditional and virtual classes concerning the boredom experienced by Iranian high school students?

Literature Review

As previously indicated, there are few studies on boredom in FL/L2 classrooms. To the best of the authors' knowledge, only few studies have a direct bearing on this problem. The discussion in the current section is limited to research that has particularly addressed the issue of boredom due to space restrictions.

For instance, German language learners and their teachers' perceptions of this unpleasant mood were examined by Chapman (2013) who showed that student attitudes toward the teacher were a significantly better predictor of boredom than the kind of tasks and activities carried out. Kruk (2016a), on the other hand, conducted a study which he examined how, over the course of three weeks, the level of boredom experienced by senior high school students learning English as a foreign language changed. He showed that while levels of worry fluctuated over time, boredom levels altered along with motivation levels and were likely to rise. He also demonstrated that participants' excitement about the chance to utilize Second Life as a tool for learning the L2, as well as a form of amusement, could be responsible for lower degrees of boredom. Kruk and Zawodniak's 2017 study looked at the connection between English majors' general boredom and their behavior in EFL classrooms (e.g., speaking, writing, grammar). Through quantitative research, it was discovered that there is a significant, positive association between overall boredom propensity and EFL class-specific boredom propensity, with the strength of this unfavorable emotion rising over time. The sense of boredom in EFL classrooms was also examined by the author's another research (Kruk & Zawodniak, 2018), who used only qualitative methods and only a sample of the participants from the prior study (Kruk & Zawodniak, 2017). In addition to the reasons for boredom in practical English classrooms and variations in its levels, the authors of the study tried to obtain an understanding of how participants manifested and coped with temporary feelings of disengagement, lack of interest, and disappointment and also

concerning potential differences of boredom experienced in practical English classrooms and various academic subjects. It was shown that the learners had a more active and innovative engagement in out-of-school boredom compared to their in-school counterparts. In another recently published study, Pawlak et al. (2020) examined 107 Polish university English students with regard to factors accounting for boredom in English classrooms. They found that disengagement, monotony and repetitiveness result in boredom in English classes, while there will also be dissatisfaction and challenges. In another study, Shehzad et al. (2020) looked into how reading boredom and reading comprehension performance are related, and how reading coping mechanisms play a mediating role. Reading comprehension performance was said to be considerably, albeit unfavorably, connected to the boredom associated with English language reading skills. The outcomes do, in fact, emphasize the importance of boredom coping mechanisms in the development of reading abilities. Pawlak et al. (2021) carried out a study to examine boredom in language instruction. With the use of data taken from a few various sources (such as boredom grids, narratives, interviews, class evaluations, and lesson plans), the researchers concluded that even though boredom could be related to various factors, it was mainly associated with repetitiveness, monotony, and predictability of what transpired over a certain class. Nearly a third of the participants in Mann and Robinson's (2009) study on university students' boredom coping mechanisms thought most lectures in higher education were dull. In fact, the findings showed that 60% of students thought at least half of their lectures were dull. Mann and Robinson's (2009) study, which sought to identify the factors that may result in boredom, found that laboratory work, online lecture notes, and PowerPoint without handouts were some factors contributing to students' boredom in higher education, while group work outside of lectures, PowerPoint with handouts, seminars, practical sessions, and group discussions in lectures were reported to be the least boredom-causing teaching practices.

There is limited research on boredom in the context of Iran. The impact of positive accomplishment emotion training on academic motivation and academic boredom in students at Dezful University of Medical Sciences was examined by Afzalzadeh et al. in 2021. The results showed that training positive achievement emotions has led to a significant increase in academic motivation and a decrease in academic exhaustion in the experimental group. Derakhshana et al. (2021) studied boredom in online classrooms in the Iranian EFL context along with its sources and solutions. The study explored the reasons for and solutions to boredom together with the time of class seemed more/less boring. It was found that educators' long, monotonous monologues, absence of learners' engagement, logistical problems, and inaccurately selected, repetitive tasks accounted as the primary sources of boredom.

As mentioned above, even though boredom is a frequent emotion faced by learners in second language classrooms, researchers and teachers have not paid enough attention to it so far. The situation of boredom as an unappreciated variable in the second language learning process motivated the researchers to carry out a series of research to compare the effect of boredom proneness in traditional and virtual classrooms.

Methodology

Design, Participants, and Context

For this study, a quantitative non-experimental research methodology was selected. Accordingly, the mode of instruction, including traditional versus virtual classes formed the independent variables of the study, while boredom was selected as the dependent variable of the study. This study was conducted with female students attending high schools in the city of Isfahan, Iran. The sample included 120 participants. Out of this number, 60 students were studying in Allameh Tabatabai Girls' High School, District 5, Isfahan. The other 60 students belonged to Farghdani

Girls' High School, District 5, Isfahan. The researcher managed the factors, such as the participants' class periods, instructional materials, and teacher, to ensure that they had no impact on this psychological variable despite the fact that the participants came from two different schools. It should be noted that both schools were situated in a "yellow zone" where there was a low but persistent risk of coronavirus infections. Parents made the decision to send their daughters to Farghadani School, while Allameh Tabatabai pupils had to participate in virtual classes in accordance with their parents' decision. According to Dörnyei and Taguchi (2010), the sample size in L2 studies should be around 50 participants in order to make reliable statements about statistical significance. With regard to the number of questionnaires distributed and returned, it can be said that the number of questionnaires returned is sufficient to make statistically relevant statements. All the students were studying in grades 10 and 11 of high school because the researcher could not access the students of grade 12 due to some administrative problems.

Measurement Instruments

The Boredom Proneness Scale (BPS) (Farmer & Sundberg, 1986) was used in this study in its translated form. The translated version of the BPS was used by Asgari and Mousavi (2010), Birami et al. (2014), and GhamkharFard et al. (2019), who all reported reliability scores of 0.74 and 0.77 for the Persian version of the questionnaire. The test's subscales include those for external stimulation, temporal perception, restrictions, affective reactions, and sustained focus. The BPS is a self-report questionnaire with 28 items that range from completely disagree to fully agree on a 7-point Likert-type scale (Farmer & Sundberg, 1989). High scores indicate a greater propensity to become bored. In addition to providing an overall score, the BPS can be used to determine an individual's scores on the two scales that make up the BPS-SR: lack of internal motivation and lack of external motivation. Items 1, 8, 11, 13, 22, and 24 made up the internal stimulation factor, while Items 6, 9, 19, 25, 27, and 28 made up the external stimulation factor.

Apart from the scale that this study incorporated, the questionnaire also included a general instruction sheet, demographic information, and a final thank-you note. As a result, the whole questionnaire, along with the greetings and instructions, demographic information, and questionnaire items were provided to the students. After the greetings and general instruction of the questionnaire, students were asked to give some demographic information. One reason for this was that some demographic information could have an influence on student boredom. Therefore, questions on demographic information included age and which year students were in. In terms of age, students were asked to write their ages in numbers in a box. As a result, data on the age of participants were metric, as age is on a ratio scale making it possible to calculate the median and mean of the participant's age.

Procedures

The teacher acted as the researcher in this study, focusing on students in the 10th and 11th grades from Farghdani and Allameh Tabatabai high schools in District 5 of Isfahan. Two groups of the participants were formed. The students of Farghdani Girls' High School were instructed to answer the items for the traditional classroom while the second group which belonged to Allameh Tabatabai Girls' High School were instructed to answer the items for the virtual one. Both groups were under the instruction of the researcher as their own teacher for both their traditional and virtual classes, so the effect of the instructor was eliminated in this study. The in-class boredom questionnaire was performed in the classroom, asking participants to score their level of boredom on a scale of 1 (least boredom) to 7 (highest boredom) (maximum). When all the items of the customized version were answered by the participants, the total scores were obtained for later analysis.

Results

This research followed a quantitative paradigm, adopting a survey design for doing the research and collecting data. To answer the research question, the total scores on the Boredom Proneness Scale were obtained from the two groups and an independent t-test was implemented, using SPSS software to see whether there were significant differences between boredom proneness in traditional and virtual classrooms or not. Coding was the first step in SPSS in which a new variable was created for each item of the survey. The response options were on the Likert-scale range from 1 to 7. The negative end of the Likert scale was assigned the number 1 in SPSS, while the positive end was assigned the number 7. Age was coded without any given value, as the age was transferred numerically into SPSS.

Table 1 entails the descriptive statistics for each component of the questionnaire. The items focus on various dimensions and representations of boredom including feeling of excitement, concentration, monotony, and so on. The mean score for boredom experience was 3.74 (SD = 0.68) for the traditional class, while the virtual class scored an average of 3.7 (SD = 0.62). This shows that the two groups experienced approximately the same level of boredom, with the traditional class scoring slightly higher. However, to examine if the differences between the groups reached a statistically significant level, a paired-sample t-test was carried out.

Table 1

Descriptive Statistics for Components of the Questionnaire

No.	Items	Group	N	Mean	SD
1	I can easily concentrate on my activities.	Traditional	64	6.06	1.23
		Virtual	60	5.83	1.48
2	I frequently find myself concerned about other things while working.	Traditional	64	2.54	1.55
		Virtual	60	2.52	1.69
3	The passage of time always seems to be slow.	Traditional	64	2.74	1.62
		Virtual	60	2.8	1.8
4	I usually find myself at “loose ends” and do not know what to do.	Traditional	64	2	1.19
		Virtual	60	1.91	1.35
5	I usually get stuck in conditions in which I need to do meaningless things.	Traditional	64	3.04	1.81
		Virtual	60	3.24	1.56
6	I become significantly bored by being forced to look at someone’s home movies or travel slides.	Traditional	64	2.24	1.48
		Virtual	60	2.52	1.69
7	I constantly have tasks and things to undertake in mind.	Traditional	64	5.42	1.34
		Virtual	60	4.85	1.63
8	I can easily entertain myself.	Traditional	64	4.58	1.48
		Virtual	60	4.04	1.91
9	Many things I must do are repetitive and monotonous.	Traditional	64	2.88	1.72
		Virtual	60	3.5	1.86
10	It takes more motivation to get me going compared to most people.	Traditional	64	2.86	1.84
		Virtual	60	2.67	1.84

11	I enjoy doing the majority of what I do.	Traditional	64	5.46	1.37
		Virtual	60	4.91	1.69
12	I am rarely excited about my work.	Traditional	64	3.88	1.92
		Virtual	60	3.81	1.64
13	In any situation I can typically find something to do or see to keep me interested.	Traditional	64	4.8	1.57
		Virtual	60	4.57	1.91
14	I mainly just sit around and do nothing.	Traditional	64	3.12	1.74
		Virtual	60	3.3	1.81
15	I am good at waiting with patience.	Traditional	64	5.1	1.58
		Virtual	60	5.35	1.75
16	Most of the time, I have time on my hands and nothing to do.	Traditional	64	3.44	2.02
		Virtual	60	3.91	1.88
17	I get very restless in conditions in which I must wait, including a line.	Traditional	64	3.26	1.82
		Virtual	60	2.67	1.67
18	I often wake up with a new idea.	Traditional	64	4.84	1.5
		Virtual	60	4.44	1.42
19	It would be very difficult for me to find a job with sufficient excitement.	Traditional	64	3.14	1.8
		Virtual	60	3.28	1.84
20	I would choose activities in life that are more difficult.	Traditional	64	5.5	1.37
		Virtual	60	5.52	1.37
21	Most of the time, I believe that I am performing below my potential.	Traditional	64	3.8	1.94
		Virtual	60	3.33	1.9
22	Many people would describe me as someone who is inventive or creative.	Traditional	64	4.88	1.42
		Virtual	60	4.7	1.22
23	I don't have enough time to pursue all of my hobbies.	Traditional	64	3.58	1.98
		Virtual	60	4.22	1.96
24	I am the one who persists in doing something the longest among my friends.	Traditional	64	2.58	1.7
		Virtual	60	2.11	1.36
25	I feel dull and half-dead unless I'm doing something interesting, maybe even risky.	Traditional	64	3.32	1.73
		Virtual	60	3.98	1.86
26	For me to truly be happy, there needs to be a lot of variation and change.	Traditional	64	3.72	1.98
		Virtual	60	4.11	1.9
27	It gets boring seeing the same stuff on television or in movies all the time.	Traditional	64	2.64	1.53
		Virtual	60	3.2	1.95
28	I spent a lot of my childhood in boring and exhausting situations.	Traditional	64	2.18	1.63
		Virtual	60	2	1.33

There are six assumptions to be checked in order to run independent-sample t-tests; the first three relate to the study design, while the other three concern characteristics of the data. According to the first assumption, there should be a dependent variable assessed on an ongoing level. As the measure of boredom could range between zero to six, it could be said that this assumption is not violated. The second assumption requires an independent variable consisting of two levels or categories. The independent variable in this study was the mode of studying, which had two levels of traditional vs. virtual classes. Thus this assumption was not violated. The third assumption assumes that there is independence of observations. More specifically, according to this assumption, the participants in the two groups should not be related. As the participants in the

study were either in the traditional group or in the virtual group, it can be claimed that this assumption is also tenable.

According to the fourth assumption, there must be no significant outliers in the two groups of the independent variable concerning the dependent variable. The inspection of boxplots for values exceeding 1.5 box-length indicated that there were no outliers in the dataset. This assumption, thus, was not violated. According to the fifth assumption, the dependent variable needs to have an almost normal distribution in every group. Shapiro-Wilk's test revealed that the dependent variable was normally distributed in both groups ($p > 0.05$). The visual inspection of histograms with the superimposed normal curve (Figures 1 and 2) further confirmed the normal distribution of the data across the groups.

Figure 1.

Histogram with Superimposed Normal Curve for Scores Across the Groups

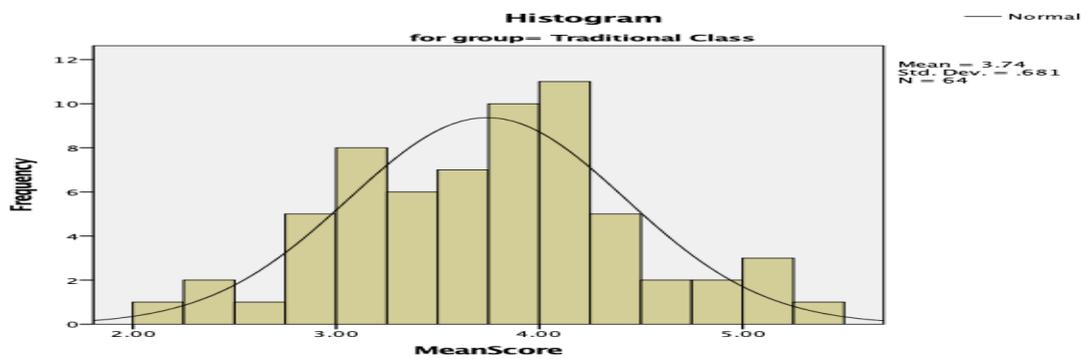
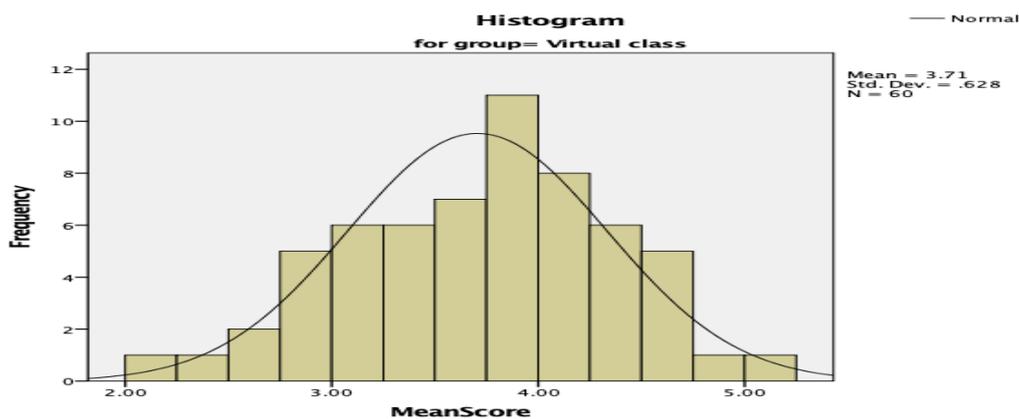


Figure 2.

Histogram with Superimposed Normal Curve for Scores Across the Groups



Finally, according to the sixth assumption, the variance should be equal in each group of the independent variable. In other words, there must be homogeneity of variances, meaning that the population variance for each group of the independent variable is the same. Levene's Test for Equality of Variances was consulted to examine this assumption, and the significance level ($p =$

0.57) showed that the assumption was tenable. That is to say, variances were found to be equal in the population too.

The t-test examined whether there were statistically significant differences existed between the level of boredom experienced in traditional and virtual classes. The results indicated that boredom in traditional classes was 0.03, 95% CI [-0.19 to 0.27] higher than virtual classes. The t-test, however, indicated that this observed difference in boredom between the two groups was not statistically significant ($t(122) = 0.31, p = .075$).

Discussion

Boredom is a prevalent emotion faced by students in classrooms and can have a variety of causes. As suggested by many researchers, boredom is a prevalent feeling among students (Nett et al., 2011), with numerous negative outcomes. As shown by the results of the study, participants of both groups experienced almost similar levels of boredom in virtual and traditional classes, with the traditional class experiencing slightly higher levels of boredom. In the same line, nearly a third of the participants, according to Mann and Robinson (2009), judged the majority of lectures in higher education to be boring. Similarly, in Tze's (2011) study, about 40% of college students admitted to getting bored in the class occasionally. Moreover, Tze et al. (2016) looked at the patterns of change in academic boredom related to the classroom and discovered that the participants had a total increase in boredom, which was ascribed to the teaching style, such as didactic lecturing in higher education. The findings confirm Sharp et al. (2019), who examined academic boredom and final-year Education Studies students' perceptions of their course experiences. They hypothesized that all participants had some measurably detectable disposition regarding academic boredom with standard lectures. Zawodniak and Kruk (2019) also suggested evidence of boredom claimed by the students from one lesson to the next and in each class. Such fluctuations showed associations with factors like language activities, organization of the lessons or their phases. Kruk et al. (2021) carried out a study to have another look at boredom in language instruction and showed that even though boredom may be associated with a variety of factors, it could be primarily related to repetitive, monotonous, and predictable tasks over a certain class. Derakhshan et al. (2021) discovered boredom among students in online classes, which is consistent with the findings of the current study. The authors concluded that the main causes of boredom were the teachers' protracted, dull monologues, the lack of student participation, operational issues, and the negligent choice of monotonous assignments. Besides, most proposed solutions focused on making the classroom happier through more teacher-student interactions, improvement of inter-personal relationships, and solving technological problems.

Conclusion and Implications

Boredom is a negative psychological and emotional state of mind when individuals are left with no activities to do or have experienced a period of dullness. FL/L2 classrooms are no exceptions in this respect. Although it has received relatively less empirical attention when compared to other learner factors, boredom is one of the most often encountered emotions in foreign and second language classrooms (Pawlak & Pasikowski, 2020). Since the present study coincided with the Covid-19 pandemic, during which most classroom education has taken place via online learning and teaching, the current research aimed to contrast the amount of boredom experienced in face-to-face with online/virtual classroom contexts, and find out if there was any relationship between the level of language proficiency and boredom proneness in different contexts. The study is one of the first research works comparing two teaching methods and their relationships with boredom in the context of Iran. According to the research findings and discussion, students may feel bored regardless of the type of class in terms of virtual or traditional methods of content delivery. On

the other hand, the results showed slightly higher levels of boredom in traditional classes, which can be a good start point to concentrate more on the comparison of these two types of classes to reach more obvious and certain results. Even though the analysis yielded valuable implications, the findings make only one piece of a very complicated puzzle and therefore more studies are required to assist us in better understanding the nature of boredom in virtual and traditional classes and the factors affecting or interacting with it.

The interesting point found in the present study was the slight difference between the two classes in terms of boredom. As previously mentioned, COVID-19 presents an unprecedented challenge for schools, universities, educational institutions, and students. All educational institutions had to change and adjust rapidly, with no enough time for teachers and students to adapt to the changing conditions. Students face boredom in online classrooms since they need to look at a single screen for a longer time and the lower levels of interaction affect their interest in the lesson adversely. However, if education is supposed to perform effectively, the learners' attention should be initially grabbed and held. Digital learning has to have much more mobility, along with personal and social identity because it is an undeniable requirement and necessity of the present time. That may seem clear, but it is apparently not. Online learning has advanced significantly in recent years, and the evolution requires to be continued. The initial goal of successfully scaling up high-quality education will be maintained if quality is increased and a better job is done of integrating education with how people actually learn.

By conclusion, virtual classrooms are promising, innovative and practical technologies both for improving learners' experiences by changing the design of the classrooms and for educators' enhancement of their own awareness in the classrooms, what works, what does not and the reason, and what options are easier in their special teaching methodologies. The only thing we need is to spend more time on investigating how to make such classrooms more attractive for students and train teachers to find ways to prevent student boredom in online environment. The change from traditional to virtual context seems inevitable, but the new kind of education should make a promising difference in students' learning outcomes.

This study includes several beneficial implications for language teaching and learning. The results of the study can provide both educators and learners with worthwhile insights into the application of virtual and traditional classroom approaches. To begin with, the findings of this study represent another step in the exploration of the concept of student boredom in two different contexts. The study helps teachers and educators to design their own lessons according to easily understandable aspects in order to maximize interest and minimize their boredom. Especially in view of the growing challenges in teaching, it is even more important for teachers to organize their lessons according to well researched concepts. Especially in foreign language teaching, interest in language, culture, and people is of particular importance to immerse oneself in language (Hiver et al., 2021). However, this active involvement in language learning can only happen with engagement. Many teachers increasingly have to deal with attention and boredom problems of students in their foreign language classes. These problems usually prevent students from sustained and effective learning, leading to negative consequences such as increased drop-out rates (Hospel et al., 2016).

This study has not only contributed to further research on student boredom in foreign language teaching in two different environments, but also has practical uses for teachers, and especially teachers of foreign languages. Since foreign language teaching particularly benefits from high student interest and enthusiasm, important conclusions can be drawn from this study, especially concerning teaching and lesson planning. By figuring out the reasons for students' boredom in the first place, both educators and learners can overcome the issue of boredom. Initially, teachers may focus on the particular reasons for boredom and therefore alter their educational practices in more successful ways to reduce students' levels of boredom. Additionally, understanding the causes of their boredom aids students in choosing effective coping mechanisms (Nett et al., 2010). Hence, teachers and students can share the responsibility

for the alleviation of boredom after identifying the roots. Likewise, the study has some implications for syllabus designers. It can attract course designers and educational authorities to how students feel in traditional as well as virtual environments. Curriculum developers and textbook writers can integrate teaching strategies that help students avoid boredom more conveniently using different techniques to help them develop as successful learners and achieve their educational goals.

Additionally, it is believed that some of the study's findings will have some implications for researchers and encourage embarking on further research. In fact, this study may motivate researchers and scholars to conduct other analytical and experimental studies in the area of learning different aspects of English in a variety of contexts by Persian EFL learners. University students who study English teaching may be also inspired by the findings of the present study and apply them in their future research works. The results can give them the required background. Another suggestion for further research would be what strategies teachers can use to promote student engagement with the class and prevent their boredom. Although there are already studies that examine, for example, cognitive-approach strategies to reduce boredom, they have mainly focused on behavioral student engagement (Eren, 2016) with less attention to the differences between virtual and traditional methods of teaching and the effects they may have separately or in combination on the student boredom. Therefore, more research on the single and combined dimensions of student boredom is required to gain a holistic picture of the construct in these two important environments.

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Declaration of Conflicting Interests

The authors declare that they have no conflicting interests related to the research presented in this manuscript. They also confirm that they have no direct or indirect financial interest in any product, service, or company that could be perceived as influencing the outcome of this research.

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