

# A Preliminary Study of Online Learning: The Influence of the Class Approaches and the Personality of Students

Tianyue Sun<sup>1,\*</sup>, Qing Yu<sup>2</sup>, Jinting Guo<sup>3</sup>, Yueqing Ma<sup>4</sup>, and Yichi Zhang<sup>5</sup>

<sup>1</sup>College of Liberal Arts and Sciences, University of Colorado Denver, Denver, Colorado 80204, USA

<sup>2</sup>School of Science, Zhejiang Sci-tech University, Hangzhou, Zhejiang 310018, China

<sup>3</sup>Beijing Haidian Kaiwen Academy, Beijing, Beijing 100195, China

<sup>4</sup>School of Foreign Studies, Jiangnan University, Wuxi, Jiangsu 214122, China

<sup>5</sup>College of Business Administration, Hebei University of Economics and Business, Shijiazhuang, Hebei 050061, China

\*Corresponding author. Email: tianyue.sun@ucdenver.edu

## ABSTRACT

With the increasing application of online learning, conflicting findings on this topic have been yielded, especially due to the outbreak of COVID-19. This study seeks to answer these two research questions: (1) Will different formats of online courses (i.e., live or recorded) generate different learning effects (i.e., the extent of students being motivated and their understandings of the course content); and (2) What kinds of students (i.e., big five personality and procrastination) are best fitted in each of these approaches? Eventually, the data of 116 participants (38 males and 78 females) are valid. As revealed by the results, the effect of different online learning approaches on academic performance is not significant. For the live courses, people who think their class participation is high are more likely to obtain better learning effects, whereas those with higher conscientiousness are less likely to achieve good learning results. For the recorded courses, people with higher agreeableness or those who think they have taken the exam seriously and taken the course timely are more likely to get a good learning effect, while outgoing people are less likely to gain a good learning effect. Combined, the results of this study have educational implications. Lastly, some limitations of this study are discussed and future research directions are suggested.

**Keywords:** *Online learning; Live or recorded courses; Big five personality; Procrastination; Self-reflection; Motivation; Academic performance*

## 1. INTRODUCTION

Online learning, as a teaching method, has been increasingly applied over the past few decades. Meanwhile, more and more colleges and institutions offer this learning method with great flexibility, which helps larger numbers of students who are busy at their careers and families to engage in advanced, professional studies. Currently, due to the outbreak of COVID-19, the world is at an unprecedented hard time. For the purpose of health and safety, schools from all over the world are being challenged to shut down temporarily. Therefore, more courses are being taught online, via Zoom or other software.

Correspondingly, online learning has gained vast research attention during this outbreak. The investigators have concluded that the study effects of online learning and traditional face-to-face teaching are comparable[1]. In other words, in general, online learning generates almost the same study outcomes as the traditional classroom courses. Even though published literatures discuss what kinds of people are best fitted in which formats of online learning, some of them lack empirical research to support. Within the small body of research that investigates the associations between students' personality characteristics

and online learning performance, conflicting findings have been yielded. For example, a study conducted on online introductory psychology students found that the introverted and extraverted students have the overall same level of performance and satisfaction[1]. By contrast, another study based on upper-level university students who had enrolled in online classes reported that extraverted people preferred traditional face-to-face courses, whereas introverted people preferred online courses. For example, in a recently published study, by analyzing the relationships between the Five Factor Model of Personality (FFM) and learning performance, Abe claimed that among the five factors of personality, both the conscientiousness and openness to experience are the robust predictors for positive academic performance. Nevertheless, a person's extraversion has no effect on his/her online learning performance[1]. As argued by Liguang Ou and Ying Sun[2], conscientiousness and openness are positively correlated with the online learning study effects, whereas neuroticism is negatively correlated and agreeableness is not significant. In contrast to Abe's findings, Ou and Sun[2] proposed that extraversion also predicts a person's academic success.

Online learning, which is just an umbrella term for learning via technology, has various format[3]. For example, online learning could be teacher-led, live classes

or self-guided, recorded classes. Based on previous, extant research, it is necessary and urgent to gain more understandings of different online learning approaches. Nonetheless, there is little systematic research on this topic. Therefore, this study seeks to answer these two research questions:

- (1) Will different formats of online courses (i.e., live or recorded) generate different study effects (i.e., the extent of students being motivated and their understandings of the course content)?
- (2) What kinds of students (i.e., big five personality and procrastination) are best fitted in each of these approaches? Correspondingly, for the first research question, we hypothesize that students who take the live courses are motivated and obtain the greatest study effects since live classes offer students an opportunity to interact with teachers and peers. For instance, students are able to ask questions timely in the chat board and teachers can answer these questions once they find a chance. On the contrary, students who watch the recorded class videos are reluctant and get the worst study effects. For the second research question, our hypothesis is that extraverted, agreeable persons or procrastinators gain most study effects from live classes, but the introverted people would benefit most from recorded classes. For conscientious, emotionally stable and enlightened learners, they are fitted in every format of online learning. A subsidiary goal of this study is

to identify the correlations among five factors of personality and procrastination.

## 2. METHODS

### 2.1. Participants

The participants are mainly students who are currently studying in high school and universities during the 2019–2020 school years and they are all Chinese native speakers. Authors divided participants into three groups (Group One= K10-K11-K12, Group Two= Freshman and sophomore, Group Three= Junior and senior). A total of 186 participants responded to the survey. 70 people was excluded, among them, 45 people did not complete the whole experiment process and 25 people already gained good understanding of the class material before the class (their pre-test scores were more than or equal to three); Therefore, A total of 116 people (58 people in live classes, 58 people in recorded classes), including 38 males (32.76%) and 78 females (67.24%), with an average age of 19.91±1.53 years, have thoroughly participated in this experiment. Meanwhile, their data are valid (see detailed demographic characteristics in Table 1).

Table 1 Sample characteristics for three education groups

	<b>Group1 K10-K11-K12 (N=21)</b>	<b>Group2 Freshman, sophomore (N=54)</b>	<b>Group3 Junior, senior (N=41)</b>
Boys, %	47.62	22.22	39.02
Girls, %	52.38	77.78	60.98
Age, M ± Std	17.76±1.69	19.83±0.63	21.12±0.89
Live class, %	52.38	53.70	43.90
Recorded class, %	47.62	46.30	56.10

### 2.2. Procedures

After anonymous online recruitment, participants first filled out a survey included a Big Five personality questionnaire[4], an academic procrastination questionnaire[5] and a pre-test. At the end of this survey, they were asked to write down their available time and contact information. The recording of the personal information had been indicated and permitted through the participant consent form. Experimenters randomly divided the participants into a live class group and a recorded class group. Each participant was assigned to a different class and joined the corresponding WeChat group chat based on the information on the survey. Participants in each class completed the course study and the final exam in their own class periods.

In live classes, the teacher, one of the experimenters, started the live class at the Tencent Meeting and turned on the camera so that the whole class could see her, and the participants were encouraged to turn on the camera and ask questions during the class time using microphone or WeChat group chat. In recorded classes, the course format was self-paced on the website. Participants could communicate with teachers and classmates using WeChat group chat in the class time.

### 2.3. Learning context

All participants took the course “Understanding Dali Through Surrealism”, which was compiled by the experimenters. It typically took 30 minutes and introduced Salvador Dali with the background information about Surrealism. The experimenters acquired this specific

knowledge through research and video materials online. The topics covered in this course include background, origin of Surrealism, Freudian influence, characteristics of Surrealism and Dali's experiences.

## 2.4. Measures

### 2.4.1. Big-five personality

As the most influential personality theory model in the world, Big Five Personality has cross-language, cross-cultural, cross-situation and cross-raters' consistency and stability[6]. As a classification system at a board level of abstraction, Big Five model can capture the commonality of most existing personality traits. Thereby, it can provide an integrated description model for research. From the review of the literature, in 2011, Chinese scholar Mengcheng Wang used the five-factor personality orientation as the theoretical framework to compile "Chinese Big Five Personality Questionnaire (Brief Version)," which has many applications and is suitable for Chinese language expression habits[4,7].

The questionnaire consists of a total of forty questions, involving 5 dimensions: "Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism." Each dimension is assessed by eight questions and each question is rated from one (Completely incompatible) to six (Fully compatible). The questionnaire has good reliability and validity, and the values of Cronbach's alpha of each dimension of the questionnaire are .70, .72, .81, .83, .84, respectively [4]. Seven of the questions are scored in reverse.

### 2.4.2. Procrastination

Academic procrastination is a complex psychological phenomenon that contains cognitive, emotional and behavioral components. In essence, it is an act or an irrational tendency to procrastinate what should be done[8]. The measurement of procrastination of college students began in the 1980s, mainly depending on self-reporting scales. Among many tools for evaluating procrastination behaviors, API, PASS and TPS (Tuckman Procrastination Scale) are commonly used and research shows that the reliability of TPS is better than that of API and PASS[9]. TPS is designed to measure the academic procrastination caused by the lack of self-management ability of college students and it has 35 items[10]. In 2007, Hongmei Zhang discussed the applicability of Chinese Tuckman's Procrastination Scale, conducted reliability and validity tests, and explored the usability. The value of Cronbach's alpha for the internal consistency reliability of the TPS was .786[5]. The questionnaire uses Likert four-point scoring, from one (completely incompatible) to four (fully compliant). Ten questions that are scored in reverse. The

higher the score is, the stronger the tendency of the individual to procrastinate in learning is.

### 2.4.3. Self-reflection

Motivation is the inner psychological force that stimulates and maintains individual activities guided by a goal or object. It is the basis of most human behaviors. Through the understanding of students' learning motivation, it is possible to explain and predict individual learning behaviors. After relevant literature was referred to, it was found that, the most widely used Chinese version learning motivation questionnaire was the Learning Motivation Scale compiled by Liping Chi in 2006. She translated and revised the learning motivation scale of Amabile et al., and examined the psychometric characteristics of the scale[11]. However, the items in this scale are not aimed at online learning, so they cannot measure students' learning motivation in the online learning environment.

Therefore, experimenters of this study developed some self-reflection questions to measure students' motivation on online learning. Though self-report measurements can result in data with poor validity, some researchers suggested that it depends on the data type[12,13]. Since motivation is an internal, personal perception, experimenters of this study considered self-reflection evaluations of individual perceptions to be more useful for the present study. Authors accepted student's own evaluation of how motivating in online learning process. The self-reflection consisted of nine Likert five-point scoring (from one, disagree strongly, to five, agree strongly) questions, which measure eight dimensions: Attendance, Completed Quiz, Participation, Interested, Enjoy, Engagement, Focus and APP Use.

### 2.4.4. Pre- & post-test

Both the pre-test and the post-test were compiled by authors based on the course content. In the pre-test, 15 questions are set, five of which are related to the course content, and there is no time limit for answering questions. If the participant answered correctly three or above of these five questions, then he/ she should be excluded from the study because three divided by five equals .6. It shows that this participant passed the exam and he/ she already had a good understanding about the class content. In the post-test, there are 15 questions referring to the course content. One hour after the start of the class, the course ended and the test papers were distributed. The test time was one hour.

To prevent participants from cheating in these two tests, authors searched on the Internet and found that no relevant answers could be found easily. Any information on the test paper is not allowed to be copied, and each participant needs to log in to the system through WeChat and can only submit it once. Besides, during the period, the video on the website for recorded classes would display "non-learning

time,” and the live classes in Tencent Meeting would be stopped.

**2.5. Data Collection and Analysis**

The messages including information about the study were collected utilizing the Wenjuanxing online survey instrument and the data were analyzed through a statistical analysis software, SPSS 26.0. The main statistical methods used are: One-factor Analysis of Variance (One-Way ANOVA), General Linear Model, Correlation and Regression.

**3. RESULTS**

**3.1. Will different formats of online courses generate different study effects ?**

One-Way ANOVA was first performed to test whether there are significant differences in the post-test scores of different online courses. It can be seen that the significance value of between groups from table 2 is .348. This value is greater than .05, which means that the learning effect is not significantly affected by the teaching method. Therefore, the first result can be derived: The effect of different online learning approaches on academic performance is not significant. Importantly, the analysis above rejects the first hypothesis.

Table 2 The effect of different teaching methods on learning outcome

Source	Sum of Square	df	MS	F	sig.
Between Groups	9.388	1	9.388	.888	.348
Within Groups	1205.121	114	10.571		
Total	1214.509	115			

Since the self-reflection survey was used to ascertain the participants' feelings and motivations about this course, a multivariate analysis of variance was then performed to test whether there are significant differences in the self-reflection score of different teaching methods. The p-values of self-rating of attendance and self-rating of participation were less than .05, which can be seen from table 3, so the influence of different online courses on students' scores

of two self-reflection questions is significantly different. By comparing the mean values of scores of these two questions in table 4, it can be known that students who received live classes rated these two questions higher than those in the recorded classes. Then the second result can be derived: The teaching method only significantly predicts two self-reflection questions: attendance and participation.

Table 3 The effect of different teaching methods on self-reflection score

Source	Dependent Variable	df	MS	F	sig.
Teaching Method	Self-Attendance	1	4.172	6.719	.011
	Self-Completed Quiz	1	.034	.074	.786
	Self-Participation	1	60.828	39.758	.000
	Self-Interested	1	1.457	1.217	.272
	Self-Enjoy	1	.216	.240	.625
	Self-Engagement	1	.009	.009	.925
	Self-Focus	1	.216	.191	.663

Table 4 Descriptive statistics of self-reflection scores in different teaching groups

	Live Group			Recorded Group		
	M	SD	N	M	SD	N
Self-Attendance	4.67	.604	58	4.29	.937	58
Self-Completed Quiz	4.48	.682	58	4.52	.682	58
Self-Participation	3.97	1.169	58	2.52	1.301	58

Also, through One-Way ANOVA, the significance of self-rating of attendance is .043, indicating that there are significant differences in the self-reflection scores of students in different grades. Compared to high school students as well as freshman and sophomore undergraduates, junior and senior undergraduates rated their attendance scores higher. The third result indicates that the effect of different grades on self-attendance scores is significant.

**3.2. What kinds of students are best fitted in each of these approaches?**

Stepwise regression was used to analyze the contributions of the Big Five personalities, procrastination and self-reflection to the post-test results. Independent variables are

Big Five personalities, procrastination and self-reflection questions. For the live group, people’s self-rating of participation ( $r = .550$ ) positively predicts their post-test score, and the adjusted R square is .290, which means participation can explain 29% of the changes in post-test results. Conscientiousness ( $r = -.260$ ) negatively predicts their post-test score, and the adjusted R square is .051, indicating that conscientiousness can only explain 5.1% of the change in post-test results. It can be seen from Table 5 and Table 6 that the p-values of conscientiousness and self-rating of participation are both less than .05, so they are both statistically significant from the analysis above, the fourth conclusion can be drawn: For live courses, people who think their class participation is high are more likely to have better learning effects. On the contrary, people with higher conscientiousness are less likely to achieve good learning results.

Table 5 Big5 regression analysis coefficient

Model		B	SE	$\beta$	t	sig.
1	(constant)	13.726	2.195		6.254	.000
	Big5-Conscientiousness	-.136	.068	-.260	-2.016	.049

Table 6 Self-Reflection regression analysis coefficient

Model		B	SE	$\beta$	t	sig.
1	(constant)	4.033	1.127		3.579	.001
	Self-Participation	1.344	.273	.550	4.927	.000

For the recorded group, a people’s self-rating completion of the quiz ( $r = .529$ ), attendance ( $r = .474$ ) and agreeableness ( $r = .281$ ) positively predict their post-test score, but their extraversion ( $r = -.285$ ) negatively predicts the post-test score. Extraversion and agreeableness can jointly explain the change of 15.1% of the post-test scores. Self-rating of attendance and self-rating of completion of quiz can explain 32.7% of the changes in post-test results. It can be seen from Table 7 and Table 8 that when these four variables are introduced into the equation, their p-

values are all less than .05, so they are all statistically significant. From the analysis above, the fifth conclusion can be drawn: For recorded courses, people with higher agreeableness or those who think they have taken the exam seriously and taken the course on time are more likely to have a good study effect. On the contrary, outgoing people are less likely to have a good learning effect. Meanwhile, the fourth and fifth results jointly overturn the second hypothesis.

Table 7 Big5 regression analysis coefficient

Model		B	SE	$\beta$	t	sig.
1	(constant)	14.117	1.938		7.285	.000
	Big5-Extraversion	-.148	.067	-.285	-2.223	.030
2	(constant)	7.664	3.106		2.467	.017
	Big5-Extraversion	-.167	.064	-.321	-2.611	.012
	Big5-Agreeableness	.216	.084	.317	2.583	.012

Table 8 Self-Reflection regression analysis coefficient

Model		B	SE	$\beta$	t	sig.
1	(constant)	-2.703	2.737	.529	-0.988	.328
	Self-Completed Quiz	2.797	.599		4.667	.000
2	(constant)	-4.451	2.781	.397	-1.638	.107
	Self-Completed Quiz	2.097	.641		3.271	.002
	Self-Attendance	1.143	.467		.297	2.450

**3.3. Correlations**

Bivariate correlations were used to analyze the correlations among the Big Five personalities and procrastination, and their correlations with self-rating of engagement. It can be seen from the table 9: (1) Openness is positively correlated with a person’s conscientiousness, extraversion and agreeableness; (2) Conscientiousness is positively correlated with a person’s extraversion and agreeableness;

(3) Agreeableness is positively correlated with the extraversion; (4) Neuroticism is negatively correlated with extraversion; and (5) Procrastination is negatively correlated with a person’s openness, conscientiousness and extraversion; however, it is positively correlated with a person’s neuroticism. These correlations were statistically significantly at  $p < .01$  or  $p < .05$ . These relationships can help analyze the feelings and reactions of people of different personalities to online courses.

Table 9 The correlations among big5 and self-reflection

	1	2	3	4	5	6	7	8
1.Big5-Openness	1							
2.Big5-Conscientiousness	.316**	1						
3.Big5-Extraversion	.507**	.226*	1					
4.Big5-Agreeableness	.448**	.223*	.232*	1				
5.Big5-Neuroticism	-.149	-.097	-.391**	.011	1			
6.Procrastination	-.237*	-.556**	-.381**	-.136	.349**	1		
7.Self-Engagement	.170	.218*	.241**	.131	-.059	-.351**	1	
8.Self-Participation	.106	-.009	.181	.093	-.077	-.117	.410**	1

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Next, the same method was performed to analyze the correlation among self-reflection questions and post-test results. It can be seen from table 10 that self-rating of interest is significantly correlated to all of the self-reflection questions, and post-test score is significantly correlated to self-rating of attendance and self-rating of interest. Then we can summarize two suggestions based on the data analysis above: First, to enhance the study effect (grades), teachers can make the class mandatory, since the

post-test score is positively correlated with the self-rating of attendance; second, for achieving better study effect, teachers can also make the class more interesting. In this way, students will express their interests in the class content, which can in turn boost their self-rating of attendance, completion of the quiz, participation, enjoyableness, engagement, concentration and eventually the post-test score.

Table 10 The correlations among self-reflection questions

	1	2	3	4	5	6	7	8
1.Self-Attendance	1							
2.Self-Completed Quiz	.397**	1						
3.Self-Participation	.312**	.251**	1					
4.Self-Interested	.278**	.345**	.403**	1				
5.Self-Enjoy	.216*	.332**	.370**	.744**	1			
6.Self-Engagement	.301**	.281**	.410**	.757**	.751**	1		
7.Self-Focus	.218*	.321**	.271**	.589**	.549**	.685**	1	
8.Post-test Score	.400**	.436**	.155	.399**	.204*	.215*	.184*	1

\*\* . Correlation is significant at the 0.01level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

**4. DISCUSSION**

**4.1. Study effects and learning formats**

Contrary to our expectation, the result demonstrates insignificant differences between the recorded course and the live course in terms of study effects. The two formats have their respective pros and cons. The recorded course, as the name implies, uses the video from the Internet directly or recorded by teachers themselves to deliver lessons, by which students can receive a fluent and flexible learning experience, and watch videos repeatedly. On the contrary, the live course enjoys an advantage in the synchronous interaction and can reach compulsory supervision by cameras. Despite the slight leading of the recorded course in average scores, it can't suggest that time flexibility and repeated watching weighs more than interaction and supervision in online learning.

Different from the close contest of study effects, students' self-rating attendance and participation in live courses are notably higher than those in the recorded ones. More specifically, students who have taken live courses have better attendance and feel more engaged in learning, which is in line with the synchronicity and interactivity of live formats. It can be concluded that live courses, possessing the coerciveness of time and interaction, have a certain constraint on students' behaviors to force them to attend classes timely and listen to teachers more attentively, which contributes to learning experiences and will influence the study effects indirectly since that in live course, people who consider their class participation significant are more likely to get higher scores. In other words, though learning formats are irrelevant to study effects directly, live courses have the advantage over recorded courses in respect of learning experiences.

Additionally, junior and senior undergraduates rated their attendance higher than other grades. The reason may be that self-discipline increases with ages. The effects of age on attendance should be taken into consideration cautiously.

**4.2. Big five personalities and teaching methods**

We hypothesize that extraversion is positively associated with study effects in live courses. Nevertheless, the results suggest that among five personalities, only conscientiousness negatively predicts study effects, which is somewhat surprising.

Previous studies have distinctive results on personalities and learning effects. Some considered conscientiousness as a positive factor to online learning. Conscientiousness, featured with self-discipline and responsibility, can restrain students to finish their learning tasks dutifully to some degree[2]. Another study on personalities and online learning showed that conscientiousness is positively correlated with academic performances both on quizzes and paper[1]. However, there is also study regarding high level of conscientiousness as no good to online learning performance[14]. These studies didn't take teaching formats into considerations and they employed different methods to measure students' performance, which might lead to the contradiction. Therefore, conscientiousness is an unclear factor relating to study effects and it may be correlated with learning environments, motivations or class contents, which requires further studies.

Out of our expectation, although extraversion is in positive correlation with online discussion[1], there is little evidence that extraversion positively predicts study effects in live courses partly due to the fact that in the live class we delivered, the teacher was the main speaker while students didn't have enough time for free speech, which

may eliminate the advantage of extraverted people. It can be inferred that extraversion doesn't perform an important role in online learning without too many expressive activities, regardless of the learning formats.

Nonetheless, higher extraversion predicts lower post-test scores in recorded classes, which means introverted people perform better in the recorded course. Introverted people are inward turning, more short-spoken and preferring self-thinking. Consistent with these features, recorded class, without interaction but providing more space for deep thinking, is less social and fits them their way of thinking. Meanwhile, the fact that people with higher agreeableness behave better in recorded course may be largely due to their willingness to cooperate with the arrangement. The results indicate that as for recorded course, taking exams seriously and attending classes punctually are both positively related to study effects. Agreeable people tend to be accommodating to cooperate with others, which may reflect in their optimistic attitudes towards online learning. Aside from extraversion and agreeableness, other personalities show subtle effects on the outcome in the recorded class.

### **4.3. Self-reflections**

It is revealed in our results that self-rating attendance and students' interests towards the class content significantly influence study effects. Attendance rates can be improved by mandatory class management, such as signing in and roll call. However, it may be a great difficulty to the recorded course, since it is featured by more flexibility and almost no management.

Apart from the original interests toward learning materials, teachers can try to arouse students' interests through adjusting class activities. The effect of online learning activities is related to the online learner's personality type while the adaptability of learners with different personality types to online learning activities will affect the learning directly [15]. Thus, teachers can design online learning activities on the basis of personalities to achieve remarkable effects. For an instance, extraverted people work significantly better than introverted people in expressive activities. Most studies about designing learning activities are from the perspective of cognitive thinking, knowledge structure and so on, neglecting the effects of personalities. Learning activities are an important and more controllable means to arouse students' interests than the content of materials. To sum up, interests are undeniably crucial to online learning but how to improve interests is still under exploration. And one vital direction may be designing activities based on personalities.

### **4.4. Mediators**

This study aims to investigate whether live and recorded courses could generate different studying effects and how

do the Big Five personality traits and procrastination rating could play a role in different online courses on students' academic performances. Moreover, through experiments and data analysis, this study examines what types of students are best fitted in live courses and what types of students are best fitted in the recorded course.

One of the potential mediators is the course contents. Because students are being tested on their academic performances regarding different studying approaches, it is essential to examine their preliminary knowledge regarding the topic so that those with a thorough understanding of the course content can be eliminated from the study. In this way, different course contents would not be advantageous towards certain groups of students. By choosing a relatively challenging course about Salvador Dali and creating a pre-test, this study can control the potential differences or biases among students regarding their previous understanding of the content. This mediator has been precisely considered and controlled during the study because its misleading tendency has been foreseen.

Another possible mediator in this study is the number of participants. The total number of students and the numerical disparity between groups both are potential variables that could influence students' academic performances. In this study, both the recorded and the live groups have 58 students, which was strictly controlled. For obtaining significant statistics and reliable results, this study recruited a total of 116 active participants.

### **4.5. Limitations**

First, a noticeable limitation of this study is the possibility of cheating. Because students were not screen monitored or supervised in person in their pre-tests and post-tests, they might have the opportunity to search the answer online. Even though the study has set up procedures to largely avoid cheating by constantly reminding the students, creating questionnaires that can only be answered once, and created questions that are challenging to find on the internet directly, it is impossible to guarantee that all forms of cheating have been successfully avoided.

Second, the unequally distributed grade level and gender displayed in the data could also play a role in participants' performances. 47 out of 116 participants are 20 years old, and there are only 20 high school students among all 116 participants. 67.2% of the participants are females. These demographic variables were not controlled; therefore, the disparity could have interfered with the results. Because of the numerical differences between genders, no conclusion could be made regarding gender and their studying effects influenced by different online learning approaches. This could also apply to ages. Because of the limited data on high school students, the results cannot show a significant relationship between online learning approaches, studying effects, and age.

Both formats of online learning have some limitations. Because the classes are not outcome-oriented and students' performances are not in linkage with their future career,

students may not have reached their optimal performance in the study. Even though their performances can be evaluated by examining their self-reflection questions, but the results of the self-reflection question could be in a lack of reliability and validity. Furthermore, in live classes, limited interactions cannot strengthen the benefits of live courses. Many of the students did not interact with the teacher or other students, and most of them failed to turn on their cameras. In the recorded classes, students had low flexibility in their courses since they only had an hour to watch the video and ask questions. The situation in which the benefits of different online learning were not maximized could weaken the differences between studying effects of the two approaches and the significance of the results.

Lastly, the lack of validity and reliability in the self-reflection questions is a considerably large limitation regarding the test of students' self-evaluated performances. Because there is currently no self-reflection scale available that is specially designed for online learning experiences, a self-made reflection question was used. These questions are in a lack of validity and reliability and have not been previously used or examined. Therefore, it is another possible limitation in the study.

## 5. FUTURE IMPLICATIONS

This study focuses on exploring the extent to which students' studying effects can be influenced by different online learning approaches, and which type of students are best fitted in each approach. Because this study has only investigated particularly in live and recorded classes, more formats of online learning should be studied to evaluate the effectiveness of them among different students. For example, more studies could be done on hybrid classes with a mixture of live and recorded classes. This future implication would not only further explain the benefits of different online learning approaches but also indicate the best one for a particular student. The results could be able to help educators design the most effective online learning approaches to trigger the optimal academic performances of students.

Regarding maximizing the benefits of different learning approaches, it is essential to investigate the effects of a camera in live classes. Cameras could play a role in students' participation and attention paying in classes, which could lead to an increase in their academic performances. Future studies should investigate the relationship between cameras in live classes and students' performances.

Another future implication is to have a comparable pre-test score and post-test score. In this study, the purpose of the pre-test was only to eliminate students with a thorough understanding of the course. However, the pre-test score cannot be compared with the post-test score to record students' growth because the scoring system and the questions are not comparable. If these tests are comparable, students' improvement or changes in their academic performances can be recorded.

Regarding our motivation scale, more studies are needed to design a self-reflection scale that could be used for online learning to improve the reliability and validity of the data. Also, future studies are needed to perform this experiment on different age groups or in different regions since this study was only focused on high school and college Mandarin speakers.

## 6. CONCLUSION

In summary, this study on online learning formats not only reveals the correlation of personalities, self-reflections and study effects, but also draws the following conclusions. Firstly, learning formats will not generate different study effects, but live courses have an upside in learning experiences. Secondly, introversion is positively related to study effects in recorded courses, yet the hypothesis of extraversion in live courses is rejected. The important findings are that the adaption degree of people with different personalities varies with online learning formats, and learning formats should be taken as a variable in research of personalities and online learning. Additionally, some practical advice can be raised to teaching staff according to our results. Some mandatory means should be properly applied into class management in order to constrain students' behaviors. In the meantime, appropriate didactical activities should be designed to exaggerate the advantages of students' personalities.

## ACKNOWLEDGMENT

The authors would like to appreciate professor Twila Tardif for her precious guidance. Also, we acknowledged the contributions Jia Lu made for recruiting the research participants.

Among five authors of this study, Jinting Guo, Yueqing Ma, and Yichi Zhang equally contributed to the work.

## REFERENCES

- [1] Abe, J. (2020). Big five, linguistic styles, and successful online learning. *The Internet and Higher Education*, 45, 1-9.
- [2] Ou, L., & Sun, Y. (2020). The influence of learner factors on online learning: Based on the analysis of big five personality and college students' academic self-efficacy. *Journal of Hubei University of Arts and Science*, 41 (2), 51-57.
- [3] Moore, J., Dickson-Deane, C., & Galyen, K. (2011). E-learning, online learning, and distance learning

environments: Are they the same? *Internet and Higher Education*, 14 (2), 129-135.

[4] Wang, M., Dai, X., & Yao, S. (2011). Development of the Chinese Big Five Personality Inventory (CBF-PI) III: Psychometric properties of CBF-PI brief version. *Chinese Journal of Clinical Psychology*, 19(4), 454-457.

[5] Zhang, H., & Zhang, Z. (2007). Usability of Tuckman Procrastination Scale in Chinese college students. *Chinese Journal of Clinical Psychology*, 15(1), 10-12.

[6] John, O.P., Naumann, L.P., & Soto, C.J. (2008). Paradigm shift to the integrative big five trait taxonomy: History, Measurement, and Conceptual issues. In: John, O. P., Robins, R. W., & Pervin, L. A. (Eds.), *Handbook of Personality: Theory and Research*, Third Edition. The Guilford Press. New York, NY. pp. 114-158.

[7] Chen, J., Xu, J., Li, H., Fan, Y., & Lu, X. (2015). The development and comparison of five-factor oriented personality test. *Advances in Psychological Science*, 23(3), 460-478.

[8] Milgram, N., Mey-Tal, G., & Levison, Y. (1998). Procrastination, generalized or specific in college students and their parents. *Personality and Individual Difference*, 25, 297-316.

[9] Pang, W. (2010). A research review on the study of college students study procrastination. *Psychology Science*, 33(1), 147-150.

[10] Bruce, W. T. (1991). The development and concurrent validity of the procrastination scale. *Educational and Psychological Measurement*, 51, 473-480.

[11] Chi, L., & Xin, Z. (2006). The measurement of college Students' learning motivation and its relationship with self-Efficacy. *Psychological Development and Education*, 2, 64-70.

[12] Chan, D. (2009). So why ask me? Are self-report data really that bad. In: Lance, C. E., & Vandenberg, R. J. (Eds.), *Statistical and methodological myths and urban legends: Doctrine, verity and fable in the organizational and social sciences*. Routledge. Abingdon, UK. pp. 309-336.

[13] Chapman, J. R., & Rich, P. J. (2018). Does educational gamification improve students' motivation? If so, which game Elements Work Best? *Journal of Education for Business*, 93 (7), 315-322.

[14] Nancy, J. S. (2018). Environmental design, personality, and online learning. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 62 (1), 1171-1175.

[15] Zhong, K., & Yang, L. (2016). The validation of online learning activities design based on the theory of personality type. *Research on Modern Distance Education* 02, 81-89.