

Is virtual learning still virtually satisfactory in the post-COVID-19 era for pre-service teachers?

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Abstract. The planned global migration to the Fourth Industrial Revolution (4IR) and the unplanned incidence of the COVID-19 pandemic have necessitated the indispensability of virtual learning adoption in tertiary institutions. The success of virtual learning is premised on many factors, including the quality of virtual learning platforms (VLPs) and users' satisfaction. This study, therefore, examined the association between VLPs and pre-service teachers (PST) satisfaction in the post-COVID-19 era. The study adopted a quantitative design using multi-stage sampling to select 200 final-year students in education faculty. The analytical methods used were Pearson product-moment correlation and independent t-test using SPSS version 29 statistical software. The findings indicated a moderately positive link between the quality of virtual learning platforms and pre-service teachers' satisfaction. However, satisfaction levels differed based on the gender of the participants. This study recommends a regular collection of feedback from the students to identify where there are hitches; higher institutions should consider creating a quality assurance department for monitoring and evaluation of the institutions' virtual learning; and training and retraining of students and instructors are essential for the update of knowledge as the new technologies continue to emerge. The uniqueness of this study is in the appraisal of pre-service teachers' knowledge and satisfaction after the COVID-19 experience. There is no iota of doubt that pre-service teachers who are preparing to be engaged in different schools need to imbibe the culture of virtual learning. Therefore, further studies must be conducted on the best way to make virtual learning attractive.

Keywords: post-COVID-19, pre-service teacher, virtual learning, virtual learning platform, satisfaction

1. Introduction

The COVID-19 pandemic has caused significant changes in the field of education, with virtual learning platforms (VLPs) becoming the standard mode of education delivery for many tertiary education institutions [3, 14]. However, there has been a prolonged debate over the effectiveness and satisfaction of virtual learning platforms, particularly in pre-service teachers' (PST) training. The paradigm shift to preparing PST via virtual learning platforms has culminated in various challenges and opportunities for developing skills and expertise in the field of education. According to Martín-Gutiérrez et al. [23], a noticeable challenge to adopting the new virtual technology is the traditional learning environment resisting the incorporation of technological innovations in teaching and learning. Virtual learning is gaining more popularity as many schools, primary, secondary, and higher institutions are interested in the best ways they can present virtual content to their online learners [13].

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Considering the critical influence of virtual learning on PST' experiences [25], it is crucial to delve into the extent to which virtual learning has been satisfactory to PST in their citadel of learning. Students can be more motivated and engaged, courtesy of the new paths to teaching and learning created by virtual technologies [23]. PST are those who have enrolled in a teacher preparation programme and are working towards a career in education. It is important to study them because of their role in educating the future generation.

Many advantages of virtual learning platforms to learners and society can be identified. VLP can potentially improve students' academic performance [18]. Furthermore, virtual learning platforms provide opportunities for learners to learn independently and at their convenience. In this contemporary world, almost all the universities in advanced countries have their forms of virtual learning platforms [17]. The essence is to help learners and support them in teaching and learning.

However, VLPs are expensive to create and keep up in terms of both time and money [17]. Given that, many VLP features might not be as beneficial to learners as designers and stakeholders may believe, wasting money and important resources.

Given these advantages and disadvantages of virtual learning platforms, this study examines pre-service teachers' experiences with virtual learning and its effectiveness in providing quality education. This study is significant and will benefit the education stakeholders, especially the school management when planning and designing the recommended curriculum and VLPs. The knowledge of PST satisfaction with the virtual learning platforms will reduce the cost of investing in them because only the features that satisfy the students will be invested in.

1.1. Statement of the problem

The widespread continuous adoption of technology is a significant shift in education delivery mode. Studies have shown that virtual learning platforms were seen as a saving grace for a spontaneous halt in the teaching and learning activities during the COVID-19 period [3, 15, 20]. Despite the innovative advantage of virtual teaching and learning, Ukutegbe, Abiodun-Oyebanji and Ileuma [32] found that many institutions and students have yet to fully adopt a virtual learning culture. Some questions are raised around how to use it and how powerful it is [6]. It is, therefore, essential to examine whether the virtual learning platform created is satisfactory to the learners (pre-service teachers) or not, especially after the COVID-19 pandemic era. There is also a crucial need to determine the best way to assess virtual learners because the traditional classroom method may not work [13]. Students' satisfaction determines the acceptability and effectiveness of these virtual learning platforms. Attention must be shifted to post-pandemic human behaviour and disposition towards virtual learning. Studies in this area are still very few compared to the scientific evidence on VLPs and students' satisfaction when COVID-19 was still around and biting. It must be reported that studies on the quality of virtual learning platforms are commonly conducted in advanced countries [19, 26] compared to the developing countries [28] and especially among pre-service teachers. It is high time the continuous use of virtual learning platforms for teaching and learning purposes after the COVID-19 pandemic in higher education institutions in developing countries is assessed.

Thus, this research focuses on examining the relationship between the use and qualities of virtual learning platforms and pre-service teachers' satisfaction in their post-COVID-19 learning

endeavours. The findings of this study will alert the education stakeholders (government, education policymakers, school leaders, teachers, parents, and well wishes) to the significance of investing in high-quality virtual learning infrastructure and resources to foster student satisfaction and retention.

1.2. Research questions

The following questions are raised in this study:

1. Is there any relationship between VLPs and PST' satisfaction?
2. Is there a difference between VLPs and PST' satisfaction based on gender?

2. Literature review

2.1. Virtual learning in brief

According to Violante and Vezzetti [33], the continuous expansion in the growth of the internet gave birth to e-services, among which is virtual learning. In higher institutions, virtual learning is considered an inevitable teaching and learning solution [6]. Virtual learning is a service rendered to students and other indirect users. It is a web-based system that brings teachers, learners and content together anytime and anywhere [17]. It is a modern-day form of education, and its adoption has also been influenced by the Fourth industrial revolution (4IR) [10]. The educational strategy known as virtual learning is a method that makes it possible for students and teachers to collaborate and acquire knowledge by using various online platforms and modern technological tools. Researchers usually employ different terms to refer to this concept, including e-learning and distant learning [30]. Virtual learning is the opposite of traditional face-to-face learning. It is popularly known for using computers, other gadgets and internet access [5]. Time distinctions allow us to classify e-learning into two broad categories: synchronous and asynchronous, with synchronous and asynchronous online classrooms representing the two primary types of learning environments [34]. Access to different digital materials and tools is one of the many advantages virtual learning offers, along with enhanced flexibility and convenience for both students and teachers alike [18]. Another advantage is the opportunity to customise instruction to meet the requirements of each student better, as well as a helpful medium for academic discussion and skills development. However, it does come with a few disadvantages, such as the requirement for dependable internet connectivity and digital gadgets, the possibility of students isolating themselves socially, and the requirement for students to be self-motivated and self-disciplined in their studies. Despite these obstacles, online education is rapidly becoming an increasingly significant component of today's educational system, and this trend will likely continue to expand and develop as new methods and technology are introduced.

2.2. Virtual learning platforms and pre-service teachers' satisfaction

The adoption of various virtual learning platforms, especially since the incidence of COVID-19, has helped pre-service teachers gain helpful knowledge of coping with ever-changing 21st-century classrooms [27, 30]. The awareness of the level of satisfaction experienced by

PST has the potential to contribute to the design and execution of efficient virtual learning strategies in educational programs for future teachers. A better grasp of the elements that determine PST's satisfaction with virtual learning in post-COVID-19 assists in making informed decisions and understanding why learners behave the way they do. In that case, concerned educational planners can design more engaging and effective virtual learning experiences that meet all students' requirements. Students' satisfaction is often described as believing that a particular system meets their needs [9]. The COVID-19 unexpected visit to the world changed many human activities. The change, not limited to education, has necessitated the adoption of technology and the Internet of Things. Teaching and learning activities have since seen virtual learning as the new normal. E-learning is now widespread [24] and globally acknowledged as an alternative to traditional classroom learning. This may not be seen as a problem, provided every participant in this new mode of teaching and learning is satisfied, especially with the mode of lesson delivery [31]. Therefore, a few factors have been identified as determinants of students' satisfaction using virtual learning platforms. Thus, the students become unsatisfied when there is a noticeable gap between the students' outcome and their predetermined expectations [9].

Success in online/virtual learning, according to Wang et al. [34], has a number of elements, such as the learning environment, instructional tactics, educational resources, and learning objectives, that have a significant impact on it. Virtual learning platforms are numerous and have different qualities and benefits. In higher education institutions, not all features of a particular VLP may benefit all students [17]. This is one of the reasons why it is crucial to study the association between VLP and students' satisfaction; more so, they are human beings and are very dynamic and unpredictable.

More importantly, when students' satisfaction with various virtual learning platforms adopted by schools will guide the platform designers to identify features that are mostly used by the students in the virtual learning platforms [17]. By extension, the school will be able to conduct a SWOT analysis of the platforms to know their strengths, weaknesses, opportunities and threats of the VLPs. A positive relationship was found between the quality of technology and medical students' satisfaction with adopting online learning [14]. The attractive quality of the virtual learning platform also determines the extent to which the user will be satisfied [33]. This is what Dumford and Miller [13] referred to as logistic consideration in online learning. Knowledge of students' satisfaction with the virtual learning platforms will guide management in improving the logistics of meeting the learners' needs for virtual learning.

Furthermore, Adewale and Tahir [3] and Elshami et al. [14] established a significant association between the instructors' support and higher institution learners' satisfaction with adopting online learning. This presupposes that the designer and adopter of any VLP must consider how the students, in this case PST, will be supported while using the platform. The explosion in the use of different social media platforms for learning and the rise in technology change [13] is a pointer to the fact that students' virtual learning satisfaction and behaviour must be understood.

A positive relationship was found by Elshami et al. [14] between the user interface and medical students' satisfaction with adopting online learning. Similarly, Luo, Murray and Crompton [21] found that PST's access to good technology enhances their technical skills. Features that benefit students influence their satisfaction [17] and, as such, must be improved, always available, accessible and attractive to the users.

Based on the review literature, the following hypotheses emerged:

- H01: There is a significant relationship between technology quality and pre-service teachers' satisfaction with virtual learning platforms.
- H02: There is no significant relationship between using VLPs and pre-service teachers' satisfaction with virtual learning platforms.
- H03: There is no significant relationship between experience with VLP and PST' satisfaction with virtual learning platforms.
- H04: There is no significant relationship between training and PST' satisfaction with virtual learning platforms.
- H05: There is no significant difference between male and female PST' satisfaction with virtual learning platforms.

2.3. Theoretical frameworks

This study is anchored on Davis's Technology Acceptance Model (TAM), which was developed in 1986 [12, 16]. The theory is famous for predicting the user's likelihood to accept technology [8, 9]. TAM explains users' motivation, producing various outcomes [10] and technology acceptance from a cognitive perspective. Primarily, the acceptance and rejection of technology in the light of TAM are determined by perceived ease of use (PEOU) and perceived usefulness (PU). This implies that the inability to establish these two factors will defeat further discussion of other theory components. Therefore, PU can be described as the extent to which the user believes the technology will enhance productivity. On the other hand, PEOU is the extent to which the user believes they need little effort to put the technology to use. The outcome of the action in TAM is a variable known as behavioural intention [16].

Applying the TAM model to a virtual learning platform implies that both PU and PEOU of the platforms for learning will determine pre-service teachers' acceptance of the virtual learning mode. In the study conducted by Almulla [6] using the framework of the technology acceptance model, it was confirmed that perceived usefulness, perceived ease of use, and computer self-efficacy of students influence their attitude towards e-learning. TAM has also been adopted by Sprenger and Schwaninger [29] to explain the acceptance of four digital learning technologies among students. The outcome showed that the students favoured three digital learning technologies except for mobile virtual reality due to their perceived usefulness. The extent to which online learning is embraced by learners can be best understood within the framework of TAM [1].

3. Material and methods

A cross-sectional quantitative research approach was used for this research study. This method will allow the researcher to study the relationship [11] between virtual learning platform use and pre-service teachers' satisfaction. This study's population comprises all PSTs in their final year in higher institutions in Lagos state, Nigeria. The rationale for targeting final-year students is that they witnessed and have used VLP during and after the COVID-19 pandemic.

The sample is the subset of the population meant to represent the population in the study [22]. This study adopted a multi-stage sampling method to determine the participants. A purposive sampling method was used to choose only two higher institutions because they offer educational courses where pre-service teachers are trained. Afterwards, students studying education courses were stratified into two major strata: the finalists or graduating students and the beginners. After which, those in the final years were included in this study. A convenient sampling method was then used to sample 200 participants who participated in the study.

The researcher adapted the questionnaire items used to elicit information from the work of Adewale, Awodiji and Ariyo [2], Adewale and Tahir [3]. The survey (appendix A) comprised two significant sections, A and B. Section A sought the participants' demographic information, while Section B sought information about the virtual learning platforms. Section B raised four items each about four constructs: technological quality, virtual learning use, virtual learning experience, and training and support. The constructs were measured on 5-level Likert scales ranging from strongly agree to strongly disagree [34] because it is easy, convenient and faster for participants to fill. The questionnaire was pilot-tested on 15 students from other faculties, excluding the faculty of education. The Cronbach's alpha method was used to determine its reliability, which yielded .87. This presupposes that the questionnaire will be consistently helpful for the purposes for which it was designed.

Furthermore, the researcher prepared the questionnaire items in Google Forms and administered them to the students' WhatsApp groups with permission. However, only 200 students responded.

The data collected through Google Forms were transformed using Microsoft Excel to screen the dataset. After that, the IBM SPSS Statistics version 28 was utilised to carry out descriptive and inferential statistical analyses. Frequency count and percentage were used to describe the participants' demographic information. Meanwhile, hypotheses one to four were tested with Pearson product-moment correlation, while hypothesis number five was tested with an independent t-test. All were tested at a .05 significance level.

Since this study concerns human beings, who constitute the participants, the ethic of relating to them in research cannot be overemphasised. The researcher secured the participants' informed consent before collecting data, assured them of their anonymity, and kept their information confidential. Hence, their identities were not revealed in this study.

4. Results

Table 1 shows the information of the participants by gender. It was found that 98 (49%) participants were male while the female among them were 102 (51%). The balanced gender distribution in this study enhances the generalizability of the results to both males and females.

Similarly, table 1 presents the participants' virtual learning platform use experience distribution in Lagos state tertiary institutions. It was found that only 14 (7%) pre-service teachers did not have a virtual platform learning experience. On the other hand, it was found that 186 (93%) of pre-service teachers have virtual platform learning experiences. This implies that the awareness rate of technology is very high among PST in tertiary institutions in Lagos state.

Figure 1 shows the commonly used virtual learning platforms among pre-service teachers

Table 1
Respondents gender distribution.

		Frequency	Percentage
Gender	Male	98	49
	Female	102	51
VLP experience	Yes	14	7
	No	186	93
Total		200	100

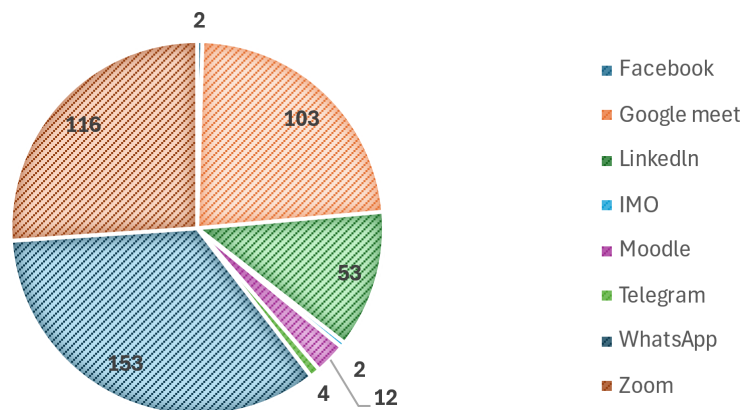


Figure 1: Commonly used virtual learning platforms among the pre-service teachers in tertiary institutions in Lagos state.

in tertiary institutions in Lagos state. It was found that WhatsApp has the highest number of users, with 153 responses, followed by Zoom users, with 116 responses, and Google Meet, with 103 responses. LinkedIn, Moodle, Telegram, IMO, and Facebook also have 53, 12, 4, 2, and 2, respectively. This implies that WhatsApp, Zoom, and Google Meet are the most used virtual learning platforms in tertiary institutions in Lagos.

This study used Pearson product-moment correlation to examine the relationship between virtual learning platforms and pre-service teachers' satisfaction. However, a preliminary analysis was conducted to avoid violating the assumptions of linearity, normality, and homoscedasticity. Table 2 indicates a moderately significant positive relationship between the virtual learning platforms and pre-service teachers' satisfaction after the COVID-19 pandemic.

Furthermore, except for an indicator (training and support), a moderator-positive relationship was found between each indicator of virtual learning platforms and PST' satisfaction. Technology quality has a moderate positive relationship with pre-teachers' satisfaction with $r = .534^{**}$, $n = 200$, and $p < .001$. Similarly, using VLP was correlated with pre-service teachers' satisfaction and a moderately significant positive relationship with $r = .514^{**}$, $n = 200$, and $p < .001$ was found. Further investigation also revealed a moderate positive relationship between VLP experience and pre-teachers' satisfaction with $r = .561^{**}$, $n = 200$, and $p < .001$.

Lastly, the study also found a significant weak positive correlation between training and

Table 2

Virtual learning platforms and satisfaction.

Variables	1	2	3	4	5
Satisfaction	1	.534**	.604**	.474**	.386**
Technology quality		1	.514**	.529**	.382**
The use of VLP			1	.561**	.273**
Experience with VLP				1	.272**
Training and support					1

Table 3

Virtual learning platforms satisfaction based on gender.

Variable	Gender	N	Mean	SD	t	df	sig	Cohen's <i>d</i>
VLP satisfaction	Male	98	3.71	.341	.942	198	.001	0.4
	Female	102	3.66	.510				

support and pre-teachers' satisfaction with $r = .272^{**}$, $n = 200$, and $p < .001$. The weak correlations suggest that other factors might substantially influence the experience and use of VLPs beyond just training and support. Therefore, to improve user satisfaction and engagement with VLPs, stakeholders should consider a broader range of factors, such as user interface design, content quality, accessibility, and personalised learning features. While training and support are important, their impact appears limited based on the given correlations, highlighting the need for a more holistic approach to enhancing virtual learning experiences.

Table 3 presents data on satisfaction with virtual learning platforms across genders. The sample consists of 98 male participants and 102 female participants. The mean satisfaction for male participants is 3.71 (SD = .341), and for female participants, it is 3.66 (SD = .510). An independent t-test was conducted to compare the satisfaction scores between male and female participants, yielding a t-value of .942, with 198 degrees of freedom. The associated p-value is .001, indicating a significant difference in gender VLP satisfaction. The effect size, measured by Cohen's *d*, is 0.4, suggesting a medium-sized effect. These outcomes suggest a statistically significant difference in satisfaction with VLP between male and female participants, with male participants reporting slightly higher satisfaction levels than female participants. In practical terms, the coefficient of variability of 13.9% indicates a relatively low degree of variability in the satisfaction levels of female respondents regarding virtual learning platforms. This suggests that their satisfaction ratings are consistent and stable.

5. Discussion

This study investigated the association between the quality of virtual learning platforms and PST' satisfaction using Pearson's product moment correlation, and a positive significant relationship was found. This implies that the more the schoolwork on the quality of the platforms it adopts to train the students, the better the increase in PST' satisfaction. This agreed with a study by

Pham et al. [26] that confirmed a relationship between e-learning and student satisfaction. The researchers said that their satisfaction will be guaranteed once their satisfaction is confirmed; if not, their loyalty will be lost. The quality should include technical and non-technical aspects because of the need for balance.

Furthermore, the study found a positive relationship between virtual learning platforms and PST' satisfaction in tertiary institutions. This presupposes that the more students see the usefulness of the virtual learning platforms, the more satisfied PST will be. The type of platform used by students usually determines the satisfaction of students in online learning [7]. The findings revealed that PST is more likely to be satisfied if the chosen virtual learning platforms are those they are used to, such as WhatsApp, Zoom, and Google Meet.

The study also found a significant difference in the satisfaction of PST in virtual learning platforms. This presupposes that gender-related factors should always be considered when designing virtual learning and choosing learning platforms. This suggests that their satisfaction ratings are consistent and stable. It also implies that any interventions or changes made to the platform will likely affect most users similarly, given the low variability in their current satisfaction levels. This corroborated the finding of a study conducted on nursing students in Saudi Arabia, where female students are more satisfied than male nursing students [4]. Likewise, Yu [35] found differences in online learning outcomes between male and female students. However, there is a dissenting study conducted in China that showed there is no difference in active learning online based on gender [34]. This shows that other factors may influence these mixed results, which may require further investigation in subsequent studies.

6. Limitations of the study

This study has limitations because the sample was limited to PST in Nigeria. This can limit the extent of the generalisation of the findings because there were no representative samples from other faculties. Also, this study does not cover other factors that may influence pre-service teachers' satisfaction, such as teachers' qualities and the level of interaction with instructors.

Therefore, future research should be directed towards filling the identified vacuums. The sample size of the future study should be increased and spread to all faculties. In addition, the future study can explore qualitative research design. It will give an in-depth understanding of other factors determining students' satisfaction with virtual learning platforms in post-COVID-19 higher education. Similarly, future studies can examine the moderating roles that other variables apart from gender can play in the association between virtual learning platform indices and students' satisfaction in the post-COVID-19 period in tertiary educational institutions.

7. Conclusion

The study's identification of a positive correlation between VLP quality and student satisfaction is a valuable finding. This suggests that investing in high-quality VLPs can have a significant positive impact on student outcomes. Conversely, the weak correlation between training and support with the experience and use of virtual learning platforms implies that these aspects alone are insufficient to improve user satisfaction and engagement significantly. Stakeholders

should recognise that while training and support are essential, they must also address other critical factors to enhance the general user experience. For instance, the user interface design should be intuitive and user-friendly. This holistic approach, which includes improving user interface design, content quality, accessibility, and personalisation, can create a more robust and satisfying learning environment. Therefore, stakeholders should invest in these areas to complement training and support efforts, leading to a more comprehensive and effective strategy for improving the use and experience of virtual learning platforms. Policies targeting the enhancement of VLP quality and accessibility can significantly improve PST satisfaction and general educational effectiveness. Investments in technical infrastructure and instructional design, prioritising usability, functionality, and learner engagement, are crucial for maximising the benefits of virtual learning environments. Continuous evaluation and adaptation of VLPs to meet diverse student populations' evolving needs and preferences are also essential. Additionally, the study's exploration of gender differences in VLP satisfaction highlights the importance of tailoring VLPs to meet the specific needs of different student populations.

Theoretically, the study emphasises the importance of considering gender-related factors in designing and implementing virtual learning environments. The findings suggest that educational institutions adopt a more inclusive approach to enhance overall satisfaction and engagement in online learning experiences. There should be a regular collection of feedback from the students to identify where there are hitches. Higher institutions should also consider creating a quality assurance department to monitor and evaluate the institutions' virtual learning.

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A. Questionnaire “Is virtual learning still virtually satisfactory in the post-COVID-19 era for pre-service teachers?”

SECTION A

Gender: Male Female

Prior experience with the use of virtual learning platforms: Yes No

Level: 100 200 300 400

Institution:

Faculty:

SECTION B

Note: VLP means virtual learning platforms

S/N	USE OF VLP	Strongly Agree	Agree	Disagree	Strongly Disagree
1	The use of VLP avail me better access to learning resources				
2	The use of VLP gives me opportunities for interactive learning and engagement				
3	The use of VLP gives me greater flexibility in my learning schedules				
4	The use of VLP has improved my learning outcomes				
	VLP EXPERIENCE	Strongly Agree	Agree	Disagree	Strongly Disagree
5	VLP are attractive				

6	VLP are dependable				
7	Using VLP is informative				
8	VLP are pleasant				
	QUALITY OF VLP	Strongly Agree	Agree	Disagree	Strongly Disagree
9	The VLP is user-friendly				
10	The device I have is compatible with my institution VLP				
11	Technical quality of VLP is encouraging				
12	Interaction in graphic design is rich				
	TRAINING AND SUPPORTS	Strongly Agree	Agree	Disagree	Strongly Disagree
13	I have received training on the use of VLP				
14	The training is sufficient for me to use VLP				
15	The training I received is different from what I met while using the knowledge				
16	I need more training on VLP				
	SATISFACTION	Strongly Agree	Agree	Disagree	Strongly Disagree
17	I will continue to applications in my school VLP				
18	I am satisfied with my institution's VLP				
19	VLP help me to cultivate self-learning ability				
20	Unrestricted learning on VLP satisfies me				