

A Study on the Effect of Online Course Adaptability Design on Students' Learning Performance

Qiwei Zhou¹, Ye Sun², Jingyu Wang ^{*}3, Yunfeng Zhang²

Qiwei Zhou: zhouqiwei@ouc.edu.cn

Ye Sun: milenasy@mpu.edu.mo

Jingyu Wang: wjy1234wjy@126.com

Yunfeng Zhang: zhangyunfeng@mpu.edu.mo

¹ College of Management, Ocean University of China, Qingdao, China

² Centre for Portuguese Studies, Macao Polytechnic University, Macao, China

³ School of Information Technology & Management, University of International Business and Economics, Beijing, China

Abstract. Online teaching has become prevalent nowadays. The effectiveness of online learning is the focus of teachers' attention in content design and curriculum quality monitoring. Drawing from Self-determination theory, from the perspective of students' identification regulatory motivation and personality of openness to experience, this paper discusses how curriculum content adaptability design affects students' learning willingness and capability. Through the longitudinal investigation of 93 students' learning in a course throughout the semester, the empirical results show that the content adaptability design of the course has a positive impact on students' learning performance, and students' identification regulatory motivation mediates the relationship. Furthermore, students' openness to experience strengthens the relationship between content adaptability design and identification regulatory motivation. This study aims to provide ideas for improving students' online learning effectiveness.

Keywords: Course adaptability design; Learning performance; Openness to experience; Identification regulatory motivation

1 Introduction

The development of digital technology has improved online teaching. Integrating online and offline learning offers one effective panacea for universities to cope with unexpected crises, and focus on long-term development. With the enrichment and in-depth development of educational resources of online learning platforms such as Massive Open Online Courses (MOOC), the importance of online learning in universities has increased. Growing attention has been paid to exploring how to enhance students' online learning performance. Despite students' reading and retrospective behaviors [1], the proper utilization of social media [2], and information literacy [3], extant research has suggested that instructors' engagement, interactions with students [4], teaching approach [5] and teaching mode [1] play crucial roles in student learning outcomes. However, it is also worth noting that it has been acknowledged for a long time that increased teacher input does not necessarily improve students' learning performance. Drawing from Self-determination Theory (hereafter referred to as "SDT"), when students perceive they have autonomy during online learning, or they can engage in online learning in a discretionary manner,

they will perceive the online course as self-determining and will be more motivated, and generate more willingness to learn, which would result in higher learning performance [6-7]. Notably, among various approaches to empower students with learning discretion, deliberate course design could leverage online learning outcomes. Albeit the accumulative research findings, knowledge is limited regarding how to facilitate students' learning performance from the perspective of course content.

This paper focuses on online course content adaptability design. It derived from the media richness theory and refers to the "degree to which users think a message can be adapted to other formats" [8] (p.726). It indicates that the design of course content could adapt to different modalities of instruction, mediums of instruction, or different purposes of instruction. Accordingly, the presentation of course content largely affects students' learning outcomes [9]. In this vein, we highlight that instructors could consider devoting more effort to conducting content adaptability design to enhance students' learning experiences [10].

Drawing from SDT, from the perspective of online course content adaptability design, this study aims to provide a possible pathway for instructors to expedite students' learning performance and further delineate how and when the relationship occurs.

2 Theory and Hypothesis

2.1 Online Course Content Adaptability Design and Identification Regulatory Motivation

According to SDT, identification regulatory motivation indicates that students identify and accept the value and importance of learning and can carry out autonomous learning behaviors without being asked to do so by others [6-7]. This study implies that course content adaptability design can promote students' identification regulatory motivation. on the one hand, the course content adaptability is designed to make the presentation of the teaching content more natural, bring students a better learning experience, enhance their sense of identification with learning, and further stimulate their motivation of identification regulation. On the other hand, since students have different learning styles and cognitive abilities, they generate different levels of adaptation to different instructional media [4]. Course content adaptability allows instructors to deliver the learning materials in more ways; learners can choose their preferred learning medium according to their learning style, and can also choose their preferred learning methods, such as when and how they submit assignments. Thus, the adaptability of the course content is designed to give students a full choice in the learning process, fully satisfying their internal need for autonomy and further motivating them to identify with the regulation [6-7]. Thus, we propose the following:

Hypothesis 1: Online course content adaptability design positively relates to students' identification regulatory motivation.

2.2 Identification Regulatory Motivation and Learning Performance

Identification regulatory motivation facilitates persistence in uninteresting but important activities [6-7]. Therefore, students with such motivation are more likely to persist during learning because they have recognized its value for themselves [6-7], which in turn facilitate better

memory and learning ability, more creative problem-solving capabilities, and thus results in better learning outcomes. In addition, previous research has demonstrated that identification regulatory motivation is positively related to student's academic performance [6], providing evidence supporting our tenet. Therefore, this study proposes that:

Hypothesis 2: Students' identification regulatory motivation is positively related to their learning performance.

Generally speaking, by enriching teaching media and beefing up content display, the online course content adaptability design provides students with more learning autonomy and discretion and creates better learning experiences by enriching teaching media. Thus, it promotes students' identification regulatory motivation and further induces their learning performance. Therefore, we propose that:

Hypothesis 3: Students' identification regulatory motivation mediates the relationship between online course content adaptability design and learning outcomes.

2.3 The Moderating Role of Openness to Experience

Openness to experience features a student with creativity, optimism, an exploratory attitude, and sensitivity to arts [11]. This study propels students' openness to experience enhances their identification regulatory motivation stimulated by content adaptability design. When students' openness to experience is high, they are more eager and receptive to new things [12]. They are more inclined to generate high learning willingness during the online course, and long to gain knowledge [13]. High-openness-to-experience students tend to face online learning with a more positive attitude, are less prone to be avoidance-oriented regarding academic motivation, and engender more meaning during online learning [14]. All these, in turn promote higher identification regulatory motivation.

In contrast, when students are less open to experience, since the less exposed online learning adaptation itself faces more limitations compared to traditional offline learning, so even if the course content adaptability is enhanced, students cannot fully appreciate the value that content adaptability brings to them, weakening the effect of content adaptation on identification regulatory motivation.

In addition, students have distinct and specific needs for autonomy and competence. Even embedded within the same environment, due to different levels of openness to experience, the higher ones would generate more satisfaction if online course content adaptability is high [14], which would, in turn facilitates identification regulatory motivation. We therefore propose:

Hypothesis 4: Students' openness to experience strengthens the relationship between online course content adaptability design and identification regulatory motivation, such that the relationship is stronger when openness to experience is higher.

Figure 1 depicts the theoretical model.

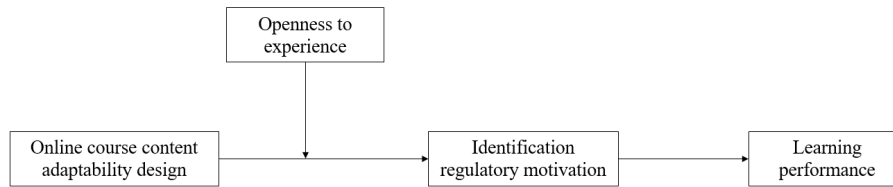


Fig. 1. Theoretical Model

3 Method

3.1 Sample

To minimize the effect of common method variance [15], a three-wave study (Time 1, Time 2 and Time 3) was designed. The data was collected in an online course “Enterprise Crisis Management” at a university located in Beijing, China. According to the roster, 102 students enrolled in the course. We invited all 102 students to participate in our online survey. At the beginning of the semester (Time 1), students were asked to self-evaluate their perceived level, of course, content adaptability, openness to experience, and demographic information. At the semester’s midterm, six weeks after Time 1, at Time 2, students were invited to report their level identification regulatory motivation. Then, At the end of the semester (Time 3), all students were asked to evaluate their learning performance during the whole course.

To eliminate students’ concerns, before conducting the research, we promised anonymity and voluntariness are guaranteed, their answers would be used for research purposes only. There would not be “right” or “wrong” in their answers; participants could withdraw at any time. The students were asked to generate a six-digit code only known to themselves. By the end of each survey (i.e., Time 1, 2 and 3), the participants were invited to fill in the six-digit code, which enables us to match the three-wave data.

For each data collection wave, we sent online survey links to all 102 students enrolled in the course through the Wechat group. At Time 1, 99 students participated in the survey. At Time 2, a total of 96 students completed surveys. At Time 3, we gained 94 responses. After data cleaning, we obtained 93 valid and matched data with a valid response rate of 91.2%. Among the 93 participants, 36 were male and 57 were female.

3.2 Measurements

We presented all survey items in Chinese. Since all the scales were originally developed in English, we followed translation/back-translation procedures to ensure participants’ proper understanding of the items. All measures were rated on a seven-point Likert scale (1 = strongly disagree, to 7 = strongly agree).

Online Course Content adaptability. We utilized the corresponding subscale from the Capabilities of Media Richness Scale [8] to measure online course content adaptability. A sample item included “The original curriculum material can be presented in different viewing modes.” Cronbach’s alpha (α) was 0.83.

Identification regulatory motivation. Identification regulatory motivation was measured using the subscale from the Self-Regulation Questionnaire (SRQ) developed by Ryan and Connell [16]. It consists of five items. Sample items included “Because I want to learn new things” and “Because I want to understand the subject”. ($\alpha = 0.74$).

Openness to experience. We invited students to report their openness to experience level using the scale developed by Costa and McCrae [17], consisting of five items. A sample item included “I enjoy learning about new ideas.” ($\alpha = 0.76$).

Learning performance. We adapted Tsui and colleagues’ [18] 11-item core task performance scale to measure students’ learning performance, as learning could be regarded as students’ “core task.” A sample item included “The duration of my learning time is higher than the average of my classmates.” ($\alpha = 0.94$).

Control variables. Gender, age, and major were included as control variables to diminish their effects on our proposed relationships.

4 Results

4.1 Confirmatory Factor Analysis

We conducted confirmatory factor analyses (CFA) and examined the distinctiveness of the four focal variables. Due to the ratio of the sample size to the total number of items would influence the overall model fit, to reduce the number of parameters that need estimating and improve model fit [19], we parceled each focal variable into three items using the item-to-construct-balance approach. As shown in Table 1, the four-factor measurement model ($\chi^2/df = 1.54$, RMSEA = 0.08, TLI = 0.94, SRMR = 0.07, CFI = 0.96) showed a better fit than the other alternative models, indicating the four focal variables are empirically distinct.

Since all the data were self-reported by students, common method bias potentially contaminates the results. Therefore, we conducted Harman’s single-factor test [15]. The one-factor model has a much poorer fit than the hypothesized four-factor model ($\chi^2/df = 6.27$, RMSEA = 0.24, TLI = 0.41, SRMR = 0.22, CFI = 0.52). In addition, the exploratory factor analysis showed the first factor accounts for 32.63% of the variance, which is lower than the threshold of 50%, indicating that our results have not been impacted largely by common method bias.

Table 1. Results of Confirmatory Factor Analysis

Models	χ^2	df	χ^2/df	$\Delta\chi^2$	RMSEA	TLI	SRMR	CFI
<i>Four-factor model:</i>								
Hypothesized four-factor model	73.73	48	1.54	—	0.08	0.94	0.07	0.96
<i>Three-factor model:</i>								
Combine identification regulatory motivation and openness to experience	108.57	51	2.13	34.84	0.11	0.87	0.09	0.90
Combine course content adaptability design and openness to experience	132.24	51	2.59	58.51	0.13	0.82	0.12	0.86

Combine identification regulatory motivation and learning performance	166.53	51	3.27	92.8	0.16	0.75	0.15	0.81
<i>Two-factor model:</i>								
Combine identification regulatory motivation, openness to experience and identification regulatory motivation	191.54	53	3.61	117.81	0.17	0.71	0.12	0.77
Combine course content adaptability design and openness to experience, and combine identification regulatory motivation and learning performance	214.22	53	4.04	140.49	0.18	0.66	0.18	0.73
<i>Single-factor model:</i>								
Combine all variables	338.50	54	6.27	264.77	0.24	0.41	0.22	0.52

Note. $\Delta\chi^2$ was compared with the hypothesized four-factor model.

4.2 Preliminary Analyses

The descriptive and bivariate correlation analysis in Table 2 indicates that content adaptability design was positively related to identification regulatory motivation ($r = 0.32, p < 0.01$), and identification regulatory motivation was positively related to learning performance ($r = 0.35, p < 0.01$). These provide initial support for our hypotheses.

Table 2. Means, Standard Deviations, Correlations, and Reliabilities.

Variables	Mean	SD	1	2	3	4	5	6	7
1. Gender	--	0.49	--						
2. Age	--	1.08	-0.23*	--					
3. Major	--	0.52	-0.16	-0.15	--				
4. Course content adaptability	6.00	0.76	0.21*	-0.14	-0.14	(0.83)			
5. Identification regulatory motivation	5.31	0.84	0.10	-0.12	-0.04	0.32**	(0.74)		
6. Openness to experience	5.61	0.82	-0.02	-0.08	0.02	0.28**	0.46**	(0.76)	
7. Learning performance	4.58	0.96	-0.15	-0.01	-0.11	0.04	0.35**	0.21*	(0.94)

Notes. $N = 93$. SD = standard deviation. Cronbach's alphas are shown in parentheses along the diagonal. For gender, man = 1, woman = 2; for major, business administration = 1, international Economics and Trade = 2, and Information Management = 3. Age was measured in years. * $p < 0.05$, ** $p < 0.01$.

4.3 Hypothesis testing

Table 3 indicates regression results for hypotheses testing. Models 1-3 take identification regulatory motivation as the dependent variable. In Model 1, only control variables (gender, age, and major) are added for regression. In Model 2, we further regress course content adaptability design based on Model 1. The results show that the association between course content adaptability design and identification regulatory motivation was positive and significant ($\beta = 0.34, p < 0.01$, Model 2). Thus, Hypothesis 1 is supported.

Models 4-6 take learning performance as the dependent variable. In Model 4, only control variables (gender, age, and major) are added for regression. In Model 5, we further regress identification regulatory motivation based on Model 4. The results show a positive and significant association between identification regulatory motivation and learning performance ($\beta = 0.42, p < 0.01$, Model 5). Thus, Hypothesis 2 is supported.

To test the mediating effect of identification regulatory motivation, we first regress both course content adaptability and identification regulatory motivation in Model 6. The results show a significant relationship between identification regulatory motivation and learning performance ($\beta = 0.44, p < 0.01$, Model 6). In contrast, the relationship between course content adaptability and learning performance is no longer significant ($\beta = -0.08, p > 0.05$, Model 6). In addition, we tested the mediation effect with the Macro in SPSS PROCESS [20] to generate 95% confidence interval [CI] with 5,000 times bootstrapping. The result shows that the indirect effect of course content adaptability on learning performance through identification regulatory motivation is 0.15 and significant (95% CI = [0.03,0.31], not including zero). Thus, Hypothesis 3 receives support.

Following the suggestions of Aiken and West [21], to eliminate the problem of multicollinearity, we centered the independent variable and the moderator, and produced their interaction term to test the moderation effect in Hypothesis 4. In Model 3, we regress the centered course content adaptability design, centered openness to experience, and their interaction term on identification regulatory motivation. Results show that the coefficient of the interaction term is positive and significant, indicating ($\beta = 0.22, p < 0.05$), indicating the moderator role of openness to experience. Further, to better interpret the results, we plot the interaction pattern in Figure 2. hypothesis 4 receives support.

Table 3. Regression Results

Variables	Identification Regulatory Motivation			Learning Performance		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constants	7.02	4.45	2.23	6.95	4.04	4.47
Control variables						
Gender	0.12	0.03	0.10	-0.37	-0.42*	-0.40
Age	-0.09	-0.06	-0.05	-0.07	-0.25	-0.04
Major	-0.08	-0.01	-0.05	-0.28	-0.03	-0.26
Main effect						
Course content adaptability design		0.34**	0.25*			-0.08
Identification regulatory motivation					0.42**	0.44**
Openness to experience			0.44**			
Moderating effect						
Course content adaptability design × Openness to experience			0.22*			
R²	-0.01	0.07	0.24	0.01	0.14	0.13
F	0.67	2.68	5.83	1.39	4.64	3.74

Notes. N = 93. * p < 0.05, ** p < 0.01.

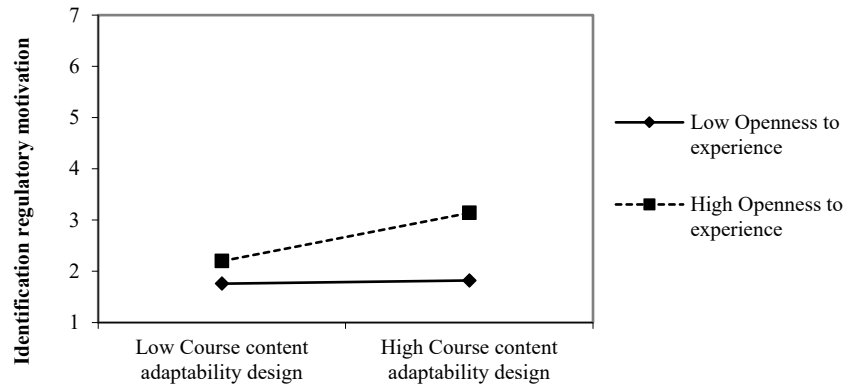


Fig. 2. Moderating Effect of Openness to Experience on the Relation of Course Content Adaptability Design with Identification Regulatory Motivation

5 Discussion

5.1 Research Findings

Drawing from SDT, this study posits and proves the mediating role of identification regulatory motivation in the relationship between course content adaptability design and student learning outcomes. The online course content adaptability design enables the presentation of teaching content to be more natural and thus reinforces students' learning motivation. Meanwhile, the adaptability design of online course content facilitates the instructor's multi-media teaching. It satisfies different students' learning styles, thus inspiring students' identification regulatory motivation, realizing the importance of learning, and further promoting them to take learning initiatives.

Also, this paper found that openness to experience enhances the relationship between online course content adaptability design and identification regulatory motivation. Specifically, the higher the students' openness to experience, the stronger the positive relationship. Such finding echoes extant evidence suggesting the predicting role of openness to experience in students' intrinsic motivation to learn English [22]. We believe the exploration of boundary conditions provides us with a more nuanced understanding of how to promote students' learning performance by modifying online course design.

5.2 Theoretical Contribution

Existing studies tend to differentiate learning motivation into controlled and autonomous motivation [7, 23], and only exceptional studies have paid attention to identification regulatory motivation and examined its impact on students' leisure-time physical activity in physical education [24]. Notably, due to the differences between extrinsic, introjected, identified regulation and intrinsic motivation and their distinct effects on individuals [6-7], it is important to zoom in

on how sheer identification regulatory motivation exerts influence. Thus, this study validates the underlying mechanism of identification regulatory motivation, which sheds light upon in-depth future research on the role of identification regulatory motivation.

Recent research has concentrated on the influence of environmental factors on teaching mode [25], teaching video presentation [26, 27], course design [28] and internal factors of learner characteristics, learning strategies, the social presence of learners [9], on students' learning performance. From a student-instructor interactive perspective, this study explores the influence of content adaptability from media richness to broaden the antecedents of learning performance.

5.3 Educational Implication

Design the teaching content adapted to online teaching and give full play to the advantages of online teaching. The role of instructors is changing from content performers to content developers [28], while the conversion of online and offline teaching lies not only in the transfer of platforms but more importantly, in the matching and fitting of content and teaching formats. Instructors should give full play to the advantages of online teaching, share learning resources, distinguish between self-study content and key teaching content, and provide students with integrated information resources. At the same time, instructors should also pay special attention to the limitations of online teaching and make appropriate trade-offs for content with special environmental requirements. For example, there are inherent challenges in delivering practical courses online, and if instructors only utilize audio, traditional slide, or lectures, students may need help understanding. In addition, instructors cannot keep track of student's mastery of knowledge, resulting in students gradually losing interest. In this regard, instructors should pay more attention, make adjustments, and integrate high-quality online resources to address this issue.

Improve the functional design of online teaching platform and provide technical support for instructors. Since different media teaching methods reflect different levels of content adaptability [8], to improve the adaptability, of course, content design, digital technology supporters should improve the development of teaching platforms. For example, integrating simple information aggregation technology with teaching, meeting the needs of different learners by the method of presentation adaptation [29] and improving the level of content adaptability presentation could lay the foundation for the adaptability design of course content. In addition, instructors should pay more attention to the multi-modality presentation of content when designing content, try to avoid relying on a single media for teaching content, and provide as many learning styles as possible to accommodate different students' preferences for different presentation methods, and in turn enhance students' identification regulatory motivation and learning outcomes. In terms of content presentation, instructors allow students to choose specific methods according to their own learning styles and preferences, such as in additional explanations, prerequisite knowledge explanations, and adding explanatory variants, and appropriately increase the ways of content presentation, such as slides or video, that is, to provide more learning options for students and thus enhance the learning performance of each student.

Mastering flexible teaching techniques to enhance students' identification regulatory motivation. Based on our research findings, students' learning outcomes could be enhanced by arousing their identification regulatory motivation. Following the Expectancy value theory, individual identification regulatory motivation is stimulated by recognizing the value of learning for

oneself. So, there would be individual differences regarding the value of learning [13]. Thus, instructors are advocated to facilitate students' intrinsic motivation to learn. Providing students with autonomy enhances their identification regulatory motivation [30]. For example, instructors could encourage students to solve problems in their way by incorporating the information provided. At the same time, instructors should avoid controlling behaviors in the teaching process, whether minor punitive measures or rewards, which may negatively affect students' identification regulatory motivation [31]. Instructors should raise the expectations and requirements for students during the teaching process [32], promptly investigate students' confusion in learning, and encourage students to actively express their learning problems, thus promoting identification regulatory motivation.

5.4 Limitations and Future Directions

There are still several limitations in this study which call for future research. On the one hand, this study was conducted on a single course in China with a small sample size, which somewhat restricts the external validity. Future research is encouraged to test the theoretical model in different contexts, especially in different cultures, to explore the potential impacts of environment further. On the other hand, although we have articulated the role of identification regulatory motivation and its antecedent (i.e., course content adaptability design), identification regulatory motivation is still a type of motivation that needs to be internalized for students, and only by cultivating students' interest in learning and achieving the integration of internal and external motivation can the quality of teaching and learning be improved at a deeper level. Thus, a deeper internalization of students' identification regulatory motivation will become an important direction for future research.

6 Conclusion

Drawing from SDT, from the perspective of students' identification regulatory motivation and personality of openness to experience, this paper discusses the mechanism of curriculum content adaptability design on students' learning willingness and capability. We concluded that the content adaptability design of the online course positively impacts students' learning performance. Students' identification regulatory motivation mediates the relationship between content adaptability design and learning performance. Furthermore, students' openness to experience personality strengthens the relationship between content adaptability design and identification regulatory motivation.

Acknowledgment: This study was supported by Beijing Social Science Foundation (No. 21GLC049).

Reference

- [1] Chettaoui, N., Atia, A., Bouhlel, M. S. (2022). Exploring the impact of interaction modality on students' learning performance. *J. Educ. Compute. Res.*, 60(1), 4-27. <https://doi.org/10.1177/0735633121102729>
- [2] Kumar, V., Nanda, P. (2022). Social media as a learning tool: A perspective on formal and informal learning. *Int. J. Educ. Reform.*, <https://doi.org/10.1177/10567879221094303>

- [3] Heriyanto, Prasetyawan, Y. Y., Krismayani, I. (2021). Distance learning information literacy: Undergraduate students experience distance learning during the COVID-19 setting. *Inform. Dev.*, 37(3), 458-466. <https://doi.org/10.1177/0266666921101824>
- [4] Brown, A. R., Voltz, B. D. (2005). Elements of effective e-learning design. *Int. Rev. Res. Open. Distrib. Learn.*, 6(1), 1-10. <https://doi.org/10.19173/irrodl.v6i1.217>
- [5] Jiang, Y. (2022). Apply Small Teaching Tactics in an Introductory Programming Course: Impact on Learning Performance. *J. Inform. Syst. Educ.*, 33(2), 149-158. <https://aisel.aisnet.org/jise/vol33/iss2/6>
- [6] Burton, K. D., Lydon, J. E., D'Alessandro, D. U., Koestner, R. (2006). The differential effects of intrinsic and identified motivation on well-being and performance: Prospective, experimental, and implicit approaches to self-determination theory. *J. Personal. Soc. Psychol.*, 91(4), 750-762. <https://doi.org/10.1037/0022-3514.91.4.750>
- [7] Wijsman, L. A., Saab, N., Warrens, M. J., van Driel, J. H., Westenberg, P. M. (2018). Relations of autonomous and controlled motivation with performance in secondary school students' favoured and disfavoured subjects. *Educ. Res. Eval.*, 24(1-2), 51-67. <https://doi.org/10.1080/13803611.2018.1512872>
- [8] Lan, Y. F., Sie, Y. S. (2010). Using RSS to support mobile learning based on media richness theory. *Computer. Educ.*, 55(2), 723-732. <https://doi.org/10.1016/j.compedu.2010.03.005>
- [9] Song, J., Chen, D., Wang, H. (2022). A study on the influencing factors of social presence on online learners' learning effect. *Sci.*, 10(3), 101-106. [10.11648/j.sjedu.20221003.13](https://doi.org/10.11648/j.sjedu.20221003.13)
- [10] Hew, K. F. (2016). Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCS. *Br. J. Educ. Technol.*, 47(2), 320-341. <https://doi.org/10.1111/bjet.12235>
- [11] McCrae, R. R., Sutin, A. R. (2009). Openness to experience. In M. R. Leary & R. H. Hoyle (Eds.), *Handbook of individual differences in social behavior* (pp. 257-273). The Guilford Press.
- [12] Komarraju, M., Karau, S. J. (2005). The relationship between the big five personality traits and academic motivation. *Personal. Individ. Differ.*, 39(3), 557-567. <https://doi.org/10.1016/j.paid.2005.02.013>
- [13] Watjatrakul, B. (2016). Online learning adoption: effects of neuroticism, openness to experience, and perceived values. *Interact. Technol. Smart. Educ.*, 13(3), 229-243. <https://doi.org/10.1108/ITSE-06-2016-0017>
- [14] Watanabe, S., Tareq, M., Kanazawa, Y. (2011). When openness to experience and conscientiousness affect continuous learning: A mediating role of intrinsic motivation and a moderating role of occupation. *Jpn. Psychol. Res.*, 53(1), 1-14. <https://doi.org/10.1111/j.1468-5884.2010.00447.x>
- [15] Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.*, 88(5), 879-903.
- [16] Ryan, R. M., Connell, J. P. (1989). Perceived locus of causality and internalization: examining reasons for acting in two domains. *J. Personal. Soc. Psychol.*, 57(5), 749-761. <https://doi.org/10.1037/0022-3514.57.5.749>
- [17] Costa, P. T., McCrae, R. R. (1985). Revised NEO Personality Inventory (NEO PI-R) and NEO Five-factor Inventory (NEO-FFI). Psychological Assessment Resources (PAR). NY: Springer.
- [18] Tsui, A. S., Porter, L. W., Egan, T. D. (2002). When both similarities and dissimilarities matter: Extending the concept of relational demography. *Hum. Relat.*, 55(8), 899-929. <https://doi.org/10.1177/00187267020550081>

- [19] Little, T. D., Rhemtulla, M., Gibson, K., Schoemann, A. M. (2013). Why the items versus parcels controversy needn't be one. *Psychol. Method.*, 18, 285-300. <https://doi.org/10.1037/a0033266>
- [20] Preacher, K. J., Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav. Res. Method.*, 40(3), 879-891. <https://doi.org/10.3758/BRM.40.3.879>
- [21] Aiken, L. S., West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. London: Sage.
- [22] Tan, C. S., Lau, X. S., Kung, Y. T., Kailsan, R. A. L. (2019). Openness to experience enhances creativity: The mediating role of intrinsic motivation and the creative process engagement. *J. Creat. Behav.*, 53(1), 109-119. <https://doi.org/10.1002/job.170>
- [23] Van Houtte, M. (2022). Students' Autonomous and Controlled Motivation in Different School Contexts: The Role of Trust. *Eur. Educ.*, 1-15. <https://doi.org/10.1080/10564934.2022.2039069>
- [24] Beasley, E. K., Garn, A. C. (2013). An investigation of adolescent girls' global self-concept, physical self-concept, identified regulation, and leisure-time physical activity in physical education. *J. Teach. Phys. Educ.*, 32(3), 237-252. <https://doi.org/10.1123/jtpe.32.3.237>
- [25] Quan, H., Guo, Z., Ni, R., Li, C., Deng, X. (2022). The influence of mixed teaching mode on the learning effects of psychology students' experiment course in higher vocational colleges. *J. Healthc. Eng.*, 2022. <https://doi.org/10.1155/2022/4190668>.
- [26] Bhardwaj, A., Gupta, A. (2023). Role of Video Lectures in Engineering Education. *Int. J. Educ. Reform.*, 32(2), 208-229. <https://doi.org/10.1177/10567879221142548>
- [27] Mo, C. Y., Wang, C., Dai, J., Jin, P. (2022). Video Playback Speed Influence on Learning Effect from the Perspective of Personalized Adaptive Learning: A Study Based on Cognitive Load Theory. *Front. Psychol.*, 13: 839982. [10.3389/fpsyg.2022.839982](https://doi.org/10.3389/fpsyg.2022.839982)
- [28] Tsang, J. T., So, M. K., Chong, A. C., Lam, B. S., Chu, A. M. (2021). Higher education during the pandemic: The predictive factors of learning effectiveness in COVID-19 online learning. *Educ. Sci.*, 11(8), 446. <https://doi.org/10.3390/educsci11080446>
- [29] El Janati, S., Maach, A., El Ghanami, D. (2018). SMART education framework for adaptation content presentation. *Proced. Computer. Sci.*, 127, 436-443. <https://doi.org/10.1016/j.procs.2018.01.141>
- [30] Ryan, A. M., Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. *Am. Educ. Res. J.*, 38(2), 437-460. <https://doi.org/10.3102/00028312038002437>
- [31] Black, A. E., Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Sci. Educ.*, 84(6), 740-756. [https://doi.org/10.1002/1098-237X\(200011\)84:6<740::AID-SCE4>3.0.CO;2-3](https://doi.org/10.1002/1098-237X(200011)84:6<740::AID-SCE4>3.0.CO;2-3)
- [32] Skinner, E. A., Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *J. Educ. Psychol.*, 85(4), 571-581. <https://doi.org/10.1037/0022-0663.85.4.571>