

SELF-EFFICACY AND ITS RELATIONSHIP WITH COMPUTER-BASED MULTIMEDIA LEARNING IN ONLINE LEARNING IN PSYCHOLOGY STUDENTS

DOI: <https://doi.org/10.26758/13.1.1>

Diego-Oswaldo CAMACHO-VEGA (1), María Guadalupe DELGADILLO-RAMOS (1)

(1) Universidad Autónoma de Baja California, Faculty of Medicine and Psychology
Address correspondence to: Diego-Oswaldo Camacho-Vega, Faculty of Medicine and Psychology, Calzada Universidad 14418, UABC, Parque Internacional Industrial Tijuana, 22390 Tijuana, B.C. E-mail: (1) diego.camacho@uabc.edu.mx (2) mayra.marquez@uabc.edu.mx

Abstract

Objectives. Based on the general hypothesis of a growing interest in using computer-based multimedia learning (CBML) in education, the objective of this study was to identify if students perceive CBML positively as an instructional tool in their online courses. A second objective was to determine if CBML is associated with self-efficacy in online courses. Finally, a third objective was to determine if higher levels of self-efficacy are associated with a positive perception of CBML.

Material and methods. Based on a cross-sectional research design, n = 98 undergraduate students enrolled in the first year of Psychology in the Faculty of Medicine and Psychology were evaluated ending their academic year about their level of self-efficacy and the perception of multimedia after taking their online courses during the Covid-19 pandemic. Sociodemographic and what's the preferred device used during their courses also were asked.

Results. Results indicated a positive perception of CBML as an instructional tool. Also, results indicated a positive correlation between CBML and online self-efficacy. Finally, higher levels of self-efficacy were associated with a positive perception of CBML as an instructional tool.

Conclusions. According to the results, CBML is a valuable resource in learning processes (particularly online), highlighting the importance of greater self-efficacy for a positive perception of using CBML.

Keywords: computer-based multimedia learning, self-efficacy, online learning.

Introduction

From around the 70s, multimedia emerged as a relevant technology used in diverse environments such as learning. In the past years, other technologies (i.e., virtual, mixed reality, internet applications, etc.) have taken more relevance in the research field. Multimedia has recovered special attention and the new generations of students appear to accept it well (Andovita & Wahyuni, 2020). Currently, the interest in multimedia has grown because of the popularity of platforms like YouTube and other online-based platforms (Wandago, Mwangi, Bozo, MianoKihu, & Mwabonje, 2020). Additionally, the Covid-19 pandemic conducted to use online applications to deliver educational courses and to incorporate multimedia as an instructional tool. However the perception of multimedia as an instructional tool in online courses on the part of the students, and the factors which promote their use remains still unclear, reason why some of these factors were explored in this research.

Computer-based Multimedia Learning

Multimedia learning refers to learning from words and pictures. Multimedia instruction refers to the presentation of material using both words and images, with the intention of promoting learning. The case for multimedia learning is based on the idea that instructional messages should be designed in light of how the human mind works, that is, presenting material in words and pictures by taking advantage of the full capacity of humans to process information (Mayer, 2009). In summary, multimedia learning involves presenting pictures and words where animation usually are presented as animations and the words are presented as narration (Mayer, Heiser, & Lonn, 2001).

According to Mayer & Moreno (2022) when multimedia learning is delivered using computers is considered Computer-based multimedia learning (CBML), and has increasingly popular use in many fields of learning and training because it stimulates new ways of delivering information with attention to accessibility, repeated use, and individualization, meeting the needs of various types of students (Krismadinata, Kurnia, Mulya, & Verawardina, 2022). The multimedia principle has been shown to be particularly effective when there is a clear and logical relationship between visual and verbal information, leading students to report higher satisfaction (Dawson et al., 2021). This hypothesis is derived from dual coding theory (Paivio, 1986) which proposes that information is processed in two different channels: a verbal and a visual channel, implicating that people learn better from a combined presentation of words and pictures (i.e., visual illustrations of what is presented verbally) than from words alone, this effect is known as the multimedia effect (as cited in Jägerskog, Jönsson, Selander, & Jonsson, 2019).

The application of digital technologies in education, especially multimedia network technologies, has brought about major changes in the content and methods of instruction. It has replaced the conventional teacher-centered, textbook-centered, and classroom-centered perspectives. Therefore, teachers are no longer the authority of knowledge. Multimedia learning materials, particularly those presented on computers, are different from more traditional learning materials on paper. In a dynamic multimedia context, students could be presented with more opportunities to engage in deep learning (Lawson & Mayer, 2021). Thus, CBML is an effective cognitive tool for students to explore freely, visualize procedures, and provide learners with a more convenient, comfortable, and effective learning environment (Zhao, He, Jin, & Wang, 2022), simulating the subjective initiative of learners, guiding learners to actively learn and construct knowledge systems promoting effective learning outcomes (Ye, Su, Zhao, & Hang, 2021).

Perceptions and utilization of CBML as a pedagogical tool

Miner and Stefaniak (2018) suggested that the use of CBML is a viable teaching resource for courses and the adoption of CBML by students depends on diverse factors such as the perceived usefulness and the ease of use of multimedia in computer-based learning. The perceived usefulness of CBML in online learning as a teaching method has shown a stronger influence on the intention than lectures and paper-based tutorials. One factor that explains this influence is the perceived ease of use of multimedia (Laosethakul & Leingpibul, 2021).

Additionally, Krause, Portolese, and Bonner (2017) found that the use of CBML as an instructional tool by teachers and students is related to engagement and some positive emotions such as enjoyment. Similarly, Hernández-Domínguez & Pérez-Cortés (2020) applying the

Technology Acceptance Model (TAM) with university students concluded that most of them reported being satisfied with the use of technological tools and consider that it positively influences their learning and performance.

Moreover, the perception of the usefulness of multimedia also has been related to another individual factor such as self-efficacy, but more research is needed to support this hypothesis.

Self-efficacy and online learning

According to Bandura (1977) self-efficacy occurs when an individual belief in his/her ability to succeed. So, they try to do what they believe they can do, choosing activities according to their efficacy beliefs and putting efforts into activities, persisting when faced obstacles (Hong, Liu, Cao, Tai, & Zhao, 2022).

Concerning self-efficacy, students who assess the efficacy of their learning and academic performance skills have an increase in their likelihood of using critical thinking skills as well as critical thinking disposition, self-regulation, self-efficacy, and self-identity, factors that are involved in preparing students for success in an online learning environment (Robinson, 2021). Particularly, Internet self-efficacy (ISE) refers to users' self-efficacy when interacting with a website, the system itself, and interactive content designed for users. ISE has been defined as an individual's belief in his/her ability to successfully use the Internet and is considered an important antecedent of the effects of e-learning (Jokisch, Schmidt, Doh, Marquard, & Wahl, 2020).

Previous findings confirm that online learning is positively related to the interactions between students and instructors, teaching presence, self-management of learning, and academic self-efficacy. In addition, student satisfaction with online learning positively predicts their intention to continue using online learning (Um & Jang, 2021). Technology can be used to deliver content but can also be strategically used to yield more opportunities for hands-on or mastery experiences and immediate feedback to improve students' self-efficacy. While planning future coursework, educators should reflect on the content being taught, course sequencing in the program, requirements for hours, and students' technological skills when determining which course delivery (Fukunaga & Kasamatsu, 2022).

It has been suggested that self-efficacy when using technology, strengthens the positive relationship between the online learning environment and student engagement, as much as the positive relationship between instructional resources and student engagement (Owusu-Agyeman, 2021).

Regarding the attitude and opinion of smart devices used by higher education students and their self-efficacy when they participate in online classes, students' perceptions of device usage, connectivity, and time duration, had a statistically significant effect on cloud-based online learning. Thus, smart devices play a vital role in extending learning outside of the classroom anywhere, anytime (Arul & Ananthi, 2021).

This research aimed at investigating if students have a positive perception of the usefulness of CBML in their online courses. Also, this research aimed to determine if there exists a correlation between self-efficacy and CBML and if a higher level of self-efficacy is associated with a better perception of the usefulness of CBML as an instructional tool in psychology students.

The hypothesis for this study was that currently, students have a positive perception of the use of CBML in their online courses (H1), being this positive perception associated with self-efficacy (H2). Finally, an additional hypothesis was that higher levels of self-efficacy are associated with a positive perception of CBML as an instructional tool (H3).

Material and Methods

This research was designed as a quantitative study using a cross-sectional design.

Participants

Data was collected from students enrolled in the first year of Psychology in the Faculty of Medicine and Psychology of one of the biggest universities in Mexico. $N = 98$ higher education students (age average = 19.66; 78% females) participated voluntarily after signing the informed consent. They were assured of the confidentiality of the data.

Instruments

Online Learning Self-Efficacy Scale (OLSES)

To evaluate the level of self-efficacy in online courses the OLSES scales developed by Zimmerman and Kulikowich (2016) and adapted by Yavuzalp & Bachcivan (2020) was administered. This version is a 21-item scale that includes three factors (learning in the online environment, time management, and technology use 21 items). The 6-point Likert scale of the original version instead of the 5-Likert point proposed by Yavuzalp & Bachcivan (2020) (1 = strongly disagree; 6 = strongly agree) was conserved in the administration of the scale (i.e., *complete all assignments on time*) because this kind of scale avoid ambiguous response.

Learning via video questionnaire

Miner and Stefaniak (2018) elaborated the learning via video questionnaire to evaluate the usefulness of multimedia videos in online courses. It is a 27-item questionnaire dealing with perceptions regarding various types of videos (i.e. *Video instruction can be an effective replacement for face-to-face instruction for some classes*). Participants ranked on a 5-point Likert scale how strongly they agree with each sentence (1 = strongly disagree; 5 = strongly agree).

Demographics and devices

Additionally, basic socio-demographic questions of name, age, and sex were asked, as well one question to know the main device used for watching the videos during the course.

Procedures

First, students enrolled in their first year of Psychology bachelors were invited to participate in the study. Due to the pandemic situation, all courses of the faculty were administrated completely online through the Blackboard Learn platform following the instructional design template provided by the Center for the Open and Online Education of the university. The study was conducted fully online at the end of the academic year during the Covid-19 pandemic.

After signing the informed consent, participants were asked to respond to the *Learning via video questionnaire* and the *OLSES questionnaire* as well some demographic questions. The

same questionnaires were administrated at the end of the course but in a posttest version. Finally, one question asking what the main device was used to take the course and watch the videos was asked.

Data analysis

To analyze data and verify the research hypothesis the JASP 0.16.2 software was used. The analysis was conducted in four stages. First, the normality of data was evaluated, determining feasible the use of parametric statistics. Second, the *r* Pearson coefficient was calculated to identify the existence of a correlation between CBML and self-efficacy. Third, the median of self-efficacy was calculated from the OLSES results to classify students with higher and low level of self-efficacy (median = 4.95), all values below the median were considered as low self-efficacy. Finally, a logistic regression was calculated to identify the association between the level of self-efficacy and perception of CBML usefulness.

Results

Determining the perception of CBML as a positive instructional tool in online learning in psychology students, results indicated that most students considered the use of CBML as a useful tool ($\bar{x} = 3.600$, $SD = 0.496$). According to the median calculated for devices, results showed that student used mainly a PC o Laptop for their online courses ($\tilde{x} = 2.000$). Descriptive statistics for all studied variables are shown in Table 1.

Table 1

Descriptive

	Age	Self- efficacy	CBML	Device
Median	19	4.950	3.63	2.000 ^a
Mean	19.663	4.715	3.600	1.918
Std. Deviation	1.406	0.871	0.496	0.371

Note.

^aPC or Laptop

Checking if CBML is associated with self-efficacy in online courses, the results suggested a positive correlation between self-efficacy and CBML ($r = .569$; $p < .001$) (see Table 2)

Table 2

Correlations between variables

Variable	Self -efficacy	Multimedia	Device
Self-efficacy	—		
Multimedia	0.569***	—	
Device	0.035	0.012	—
Self-efficacy level	0.711***	0.461***	-0.023

Note. *** $p < .001$

Then, to determine if a higher level of self-efficacy is associated with CBML, a logistic regression was calculated. As is shown in Table 2, the logistic regression model was statistically significant $\chi^2(96) = 22.903, p < .001$, indicating that the model explains 28% (Nagelkerke R^2) of the variance in CBML. The odds of perceiving the positive use of CBML are 9.851 times for participants with higher levels of self-efficacy (odds ratio, $p < .001$). In other words, the positive perception of the use of CBML is associated with higher levels of self-efficacy (see Table 3).

Table 3

Logistic regression

Model	Deviance	AIC	BIC	df	X²	P	McFadden R²	Nagelkerke R²	Tjur R²	Cox & Snell R²
H ₀	134.835	136.835	139.42	97						
H ₁	111.932	115.932	121.102	96	22.9	< .001	0.17	0.279	0.212	0.208

Coefficients							
	Estimate	Standard Error	Standardized⁺	Odds Ratio	z	Wald Statistic	p
CBML	2.288	0.55	1.135	9.851	4.159	17.297	< .001

Discussion

In line with the first hypothesis, students appear to have a positive perception of the use of CBML in online courses, in agreement with Miner and Stefaniak (2018), who suggested that the use of CBML is a viable teaching resource to communicate course content, albeit it is worth mentioning that not so hard as expected for this study. With regard to the second hypothesis, this positive perception is associated with self-efficacy (H2) supporting the findings provided by Cheung, Li, and Yee (2003). Regarding the third hypothesis, higher levels of self-efficacy were associated with a positive perception of the usefulness of CBML, in line with Zheng, Mcalack, Wilmes, Kohler-Evans, and Williamson (2009).

The use of CBML as a potentially valuable instructional tool has been reported various years ago (Mayer et al., 2001), being an important resource due to the capacity to work with the visual and auditive processes which are the basis for the dual-channel theory. Over time, the use of CBML was supplied by novel tools such as virtual and mixed reality (Miranda & Vieira, 2019), intelligent agents (Trevors, Reza, Azevedo, & Bouchet, 2016), etc. Nonetheless, through the emergence of online platforms such as YouTube, the interest in CBML started to grow again and the use of CBML recover its importance as a pedagogical tool (Wandago, et al., 2020) which is consistent with the H1. However, the use of videos as an instructional tool by the new generation of students appears to be different compared with previous generations. Recent research has shown that now, students prefer short content when they access multimedia in their courses (Zhang, 2020) which implies an update in the understanding of this phenomenon.

But the growing use of CBML as an instructional tool in recent years has not been analyzed enough. There are several factors involved in the perception of the usefulness of CBML (Andovita & Wahyuni, 2020). Hypotheses H2 and H3 add theoretical information to consider self-efficacy as an important factor that helps students to have a better perception of the use of CBML. Some studies have evidenced that a better perception of multimedia resources is related to engagement in online courses (Chakraborty, 2019). However, further studies should analyze the importance of the characteristics of the CBML content (i.e., quality of audio and image, quality of explanation by the professor) which are some of the limitations of this study.

An additional finding showed that students use PC or Laptops as the main device to take their online courses and watch the videos which correspond to the course, opposite to the general hypothesis of the use of smartphones as the main device to access to CBML.

Conclusions

In conclusion, this research provided evidence of the importance of considering the development of self-efficacy in psychology students. Self-efficacy has demonstrated several benefits in the learning field (Vongkulluksn et al., 2017; Chen et al., 2022), and this study provided evidence of its importance in CBML use as a process of self-regulated learning (Moghadari, et al., 2020; Huang Y, Chan H, Wang Y, et al, 2023). This study also evidences the need to research other important factors for understanding the use of CBML in online courses such as e-learning motivation and task value in online environments (Keskin & Yurdugül, 2020; Nguyen & Tang, 2022).

References

1. Andovita, L. G., & Wahyuni, A. (2020). Students' perception towards the use of multimedia-based teaching material. *JHSS Journal of Humanities and Social Studies*, 4(1), 10-13. Retrieved October 27, 2022 from <https://journal.unpak.ac.id/index.php/jhss/article/view/1902>
2. Arul L. R., & Ananthi C., M. (2021). Accelerating the Move Towards Online Learning Through Cloud Platforms in Higher Education Sectors Using Smart Devices during COVID-19. *International Journal of Interactive Mobile Technologies*, 15(10), 33–48. doi.org/10.3991/ijim.v15i10.22163
3. Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215. doi.org/10.1037/0033-295X.84.2.191
4. Chakraborty, M. (2019). Impact of Multimedia on Learners' Engagement: An Experimental Study. *Journal of Information and Computational Science*, 9(10), 196, 206. Retrieved October 30, 2022 from <http://www.joics.org/gallery/ics-1494.pdf>
5. Chen, X., Zhao, H., & Zhang, D. (2022). Effect of Teacher Support on Adolescents' Positive Academic Emotion in China: Mediating Role of Psychological Suzhi and General Self-Efficacy. *International Journal of Environmental Research and Public Health*, 19(24), 16635. <https://doi.org/10.3390/ijerph192416635>
6. Cheung, W. Li, E. Y., & Yee, L. W. (2003). Multimedia learning system and its effect on self-efficacy in database modeling and design: an exploratory study. *Computers & Education*, 41, 249–270. [http://doi.101016/S0360-1315\(03\)0048-4](https://doi.org/10.1016/S0360-1315(03)0048-4)
7. Dawson, K., Zhu, J., Ritzhaupt, A. D., Antonenko, P., Saunders, K., Wang, J., & Lombardino, L. (2021). The influence of the multimedia and modality principles on the learning outcomes, satisfaction, and mental effort of college students with and without dyslexia. *Annals of Dyslexia*, 71(1), 188–210. doi.org/10.1007/s11881-021-00219-z
8. Fukunaga, M. M., & Kasamatsu, T. M. (2022). Purposeful Course Planning: Considering Student Self-Efficacies When Selecting an Online, Hybrid, or Face-to-Face Course Delivery Modality. *Athletic Training Education Journal*, 17(3), 201–209. doi.org/10.4085/1947-380X-21-038
9. Hernández-Domínguez, J., & Pérez-Cortés, A.J. (2020). Analysis of the Technological Acceptance of Multimedia Tools at University Physical Education Learning. *Journal of Sport & Health Research*, 12(2), 248-259. Retrieved October 29, 2022 from <https://digibug.ugr.es/handle/10481/64326?show=full>
10. Hong, J. C., Liu, X., Cao, W., Tai, K. H., & Zhao, L. (2022). Effects of Self-Efficacy and Online Learning Mind States on Learning Ineffectiveness during the COVID-19 Lockdown. *Educational Technology and Society*, 25(1), 142–154. Retrieved October 28, 2022 from <https://www.jstor.org/stable/48647036>
11. Huang, Y, Chan, H, Wang, Y, et al (2023). Effects of a blended multimedia teaching approach on self-efficacy and skills in over-the-counter medication counselling versus a lecture-based approach: protocol for a prospective cohort study of undergraduate students from a pharmacy school in Taiwan *BMJ Open* 13:e068738. doi: 10.1136/bmjopen-2022-068738
12. Jägerskog, A. S., Jönsson, F. U., Selander, S., & Jonsson, B. (2019). Multimedia learning trumps retrieval practice in psychology teaching. *Scandinavian Journal of Psychology*, 60(3), 222–230. doi.org/10.1111/sjop.12527

13. Jokisch, M. R., Schmidt, L. I., Doh, M., Marquard, M., & Wahl, H. W. (2020). The Role of internet self-efficacy, innovativeness, and technology avoidance in breadth of internet use: Comparing older technology experts and non-experts. *Computers in Human Behavior*, *111*, 106408. doi.org/10.1016/j.chb.2020.106408
14. Keskin, S., & Yurdugül, H. (2020). Factors Affecting Students' Preferences for Online and Blended Learning: Motivational Vs. Cognitive. *European Journal of Open, Distance and E-Learning*, *22*(2), 72–86. doi.org/10.2478/eurodl-2019-0011
15. Krause, J., Portolese, L., & Bonner, J. (2017). Student perceptions of the use of multimedia for online course communication. *Online Learning Journal*, *21*(3), 36–49. doi.org/10.24059/olj.v21i3.1198
16. Krismadinata, Kurnia, U. I., Mulya, R., & Verawardina, U. (2022). The Interactive Multimedia Learning for Power Electronics Course. *International Journal of Online and Biomedical Engineering*, *18*(7), 44–56. doi.org/10.3991/ijoe.v18i07.30029
17. Laosethakul, K., & Leingpibul, T. (2021). Investigating Student Perception and Behavioral Intention to Use Multimedia Teaching Methods for the SAP ERP System. *E-Journal of Business Education and Scholarship Teaching*, *15*(1), 1. Retrieved October 30, 2022 from <https://eric.ed.gov/?id=EJ1299988>
18. Lawson, A.P., & Mayer, R.E. (2021). Benefits of Writing an Explanation During Pauses in Multimedia Lessons. *Educational Psychology Review*, *33*(4), 1859-1885. <https://doi.org/10.1007/s10648-021-09594-w>
19. Mayer, R. E. & Moreno, R. (2022). Aids to computer-based multimedia learning. *Learning and Instruction*, *12*(1), 107-119. [https://doi.org/10.1016/S0959-4752\(01\)00018-4](https://doi.org/10.1016/S0959-4752(01)00018-4)
20. Mayer, R., Heiser, J., & Lonn, S. (2001). Cognitive Constraints on Multimedia Learning: When Presenting More Material Results in Less Understanding. *Journal of Educational Psychology*, *93*(1), 187-198. <https://psycnet.apa.org/doi/10.1037/0022-0663.93.1.187>
21. Mayer, R.E. (2009). *Multimedia Learning: Vol. 2nd ed.* Cambridge University Press.
22. Miner, S. & Stefaniak, J. E. (2018). Learning via Video in Higher Education: An Exploration of Instructor and Student Perceptions. *Journal of University Teaching & Learning Practice*, *15*(2), 1-14. Retrieved October 30, 2022 from <https://ro.uow.edu.au/jutlp/vol15/iss2/2>
23. Miranda, A. R., & Vieira, A. M. (2019). Immersive virtual reality environment as a strategic tool to enhance the user experience. *Cuadernos del Centro de estudios en Diseño y Comunicación*, *87*, 267-283. Retrieved October 29, 2022 from <http://www.scielo.org.ar/pdf/ccedce/n87/1853-3523-ccedce-87-257.pdf>
24. Moghadari, M., Moghadasi-Amiri, M., Cheraghi, F., Mozafari, H., Imani, B., & Zandieh, M. (2020). Self-Efficacy, Self-Regulated Learning, and Motivation as Factors Influencing Academic Achievement Among Paramedical Students: A correlational Study. *Journal of Allied Health*, *49*(3), 221-228. Retrieved October 30, 2022 from <https://pubmed.ncbi.nlm.nih.gov/32877483/>
25. [Nguyen, H.T. & Tang, C.W. \(2022\). Students' Intention to Take E-Learning Courses during the COVID-19 Pandemic: A Protection Motivation Theory Perspective. *International Review of Research in Open and Distributed Learning*, *23*\(3\), 21-42. <https://doi.org/10.19173/irrodl.v23i3.6178>](#)
26. Owusu-Agyeman, Y. (2021). The COVID-19 pandemic and student engagement in online learning: The moderating effect of technology self-efficacy. *Journal of Pedagogical Research*, *5*(4), 119–139. doi.org/10.33902/jpr.2021473586

27. Robinson, L. J. (2021). Investigating critical thinking disposition, self-efficacy, self-regulation, and self-identity amongst online students. *College Student Journal*, 55(3), 325–337. Retrieved October 29, 2022 from <https://www.ingentaconnect.com/content/prin/csj/2021/00000055/00000003/art00008>
28. Trevors, G., Reza, F-B, Azevedo, R., & Bouchet, F. (2016). Self-regulated learning processes vary as a function of epistemic beliefs and contexts: Mixed method evidence from eye tracking and concurrent and retrospective reports. *Learning and Instruction*, 42, 31-46. doi.org/10.1016/j.learninstruc.2015.11.003
29. Um, N. H., & Jang, A. (2021). Antecedents and consequences of college students' satisfaction with online learning. *Social Behavior and Personality*, 49(8). doi.org/10.2224/sbp.10397
30. Vongkulluksn, V. W, Mukhopadhyay, A., Sinatra, G. M., & Marsh, J. (2017). The Influence of Academic Emotions on Self-Efficacy and Situational Interest Trajectories during an Elementary School Makerspace Program. *International Journal of STEM Education*, 5(43), 1-19. <https://doi.org/10.1186/s40594-018-0129-0>
31. Wandago, O., Mwangi, A., Bozo, J., MianoKihu, P., & Mwabonje, R. (2020). *Applicability of the YouTube as a Pedagogical Tool in Technical and Vocational Education and Training*. Paper presented at the 5th International TVET and Interdisciplinary Conference, Rift Valley Technical Training Institute, Eldoret, Kenya. Retrieved October 28, 2022 from https://www.researchgate.net/publication/303683596_The_effectiveness_of_YouTube_as_a_pedagogical_tool_in_TVET_training
32. Yavuzalp, N., & Bahcivan, E. (2020)._The Online Learning Self-efficacy Scale: Its Adaptation Into Turkish and Interpretation According To Various Variables. *Turkish Online Journal of Distance Education-TOJDE*, 21(1). doi.org/10.17718/tojde.674388
33. Ye, L., Su, H., Zhao, J., & Hang, Y. (2021). The Impact of Multimedia Effect on Art Learning: Eye Movement Evidence from Traditional Chinese Pattern Learning. *International Journal of Art and Design Education*, 40(2), 342–358. doi.org/10.1111/jade.12347
34. Zhang, T. (2020). A Brief Study on Short Video Platform and Education. *Proceedings of the 2nd International Conference on Literature, Art and Human Development (ICLAHD 2020)*. *Advances in Social Science, Education and Humanities Research*, 497, 543-547. Retrieved October 30, 2022 from https://www.researchgate.net/publication/347953414_A_Brief_Study_on_Short_Video_Platform_and_Education
35. Zhao, E., He, J., Jin, Z., & Wang, Y. (2022). Student-Centered Learning Environment Based on Multimedia Big Data Analysis. *Mobile Information Systems*, 2022. [doi.org/https://doi.org/10.1155/2022/9572413](https://doi.org/10.1155/2022/9572413)
36. Zheng, R., Mcalack, M., Wilmes, B., Kohler-Evans, P., & Williamson, J. (2009). Effects of multimedia on cognitive load, self-efficacy, and multiple rule-based problem-solving. *British Journal of Educational Technology*, 40(5), 790-803. <https://doi.org/10.1111/j.1467-8535.2008.00859.x>
37. Zimmerman, W., & Kulikowich, J. M. (2016). Online Learning Self-Efficacy in Students With and Without Online Learning Experience, *American Journal of Distance Education* 30(3), <https://doi.org/10.1080/08923647.2016.1193801>