
EMPIRICAL STUDY ON WEB-BASED LEARNING IN HIGHER EDUCATION: AN EXAMINATION OF STUDENTS' LEARNING EXPERIENCES

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ABSTRACT

Web-based learning programs have shown to be interesting and interactive environment for learners which are practically distinct from traditional classroom practices. Although the use of web-based learning has since been practiced in most institutions globally, there is a need to assess students' learning experiences using web-based learning systems. Hence, this study is an empirical study carried out to assess students' learning experiences using a web-based learning approach in higher education in determining their academic performances. A descriptive survey was adopted as a research design for the study. 150 students were randomly selected from a population of 240 through a stratified sampling technique from the three departments of a tertiary institution in Ghana where the study was conducted. Data on the assessment of student's learning experiences were collected using a five-point Likert scale questionnaire ranging from strongly agree to strongly disagree. Descriptive statistics and percentage responses were used for data analysis and interpretation. Student's participation was voluntary and their responses were kept confidential. The study revealed that students were more interested and engaged using web-based learning for their study which also increases their learning performance. The study provided some suggestions for institutions to adopt the use of web-based learning in their curriculum as a learning method and as a means of strengthening its usage which will enhance future learning experience among students as well as symposiums on web-based learning practices.

Key Words Web-based learning, student learning, flexible learning, learning experiences, web platform.

1. INTRODUCTION

With the intervention of information technology, the pace of life has accelerated likewise the speed of technological advancement has increased and our world more globalized (Divéki, 2018). In other words, the educational world has undergone tremendous changes (Zhang & Tian, 2019) with the rapid development of information technology. Technology advancement and integration in education affected the invention of new educational programs with interesting and interactive environments for learners that are practically distinct from traditional classroom

practices. Lately, learning has become more flexible than ever which gives more motivation to learners who seem disadvantaged with traditional methods of learning. The present educational system around the globe is currently witnessing the replacement and, in some cases, the blended approach to traditional learning methods with other learning modes such as Mobile learning, Computer-based Learning (CBL), Web-based learning, etc. With these technological innovations in education, it has been proven according to (Thamrin, Suriaman&Maghfirah, 2019) that learning not only can be done in the classroom. Hence, there is a need for students to familiarise themselves with different learning modes for effective learning (Gros et al, 2012). Previous studies have shown that are promising interaction opportunities for students who participated in certain learning mode as a way of influencing their learning outcomes (Orenstein, 2014; Zacharis, 2015).

Enhancing the flexibility of learning is unleashing web-based learning as a flexible learning medium that can bring about change in learning approaches that has the possibilities to meet the desire needs of the 21st-century students at different location. Ray (2012) pointed out that, web-based learning has the potential to meet the perceived need for flexible pace, place, and face, which further shift education to go in the ways of the learners rather than learners shifting towards education. It could be seen that web-based learning is becoming more popular among stakeholders in education due to its flexibility and adaptive natures that suit most educational systems. At an individual level, students are more interested in web learning classes than the traditional learning method which previously was referred by some scholars to be teachers centric (Ding & Zhang, 2018; Zhang X. et al, 2019 and Abedi, Keshmirshakan, &Namaziandost, 2019). For some students, they will feel the connectedness with other learners when engaged in a web classroom. Web learning also stimulates students' learning interest as well as their satisfaction in the exchange of ideas.

The traditional learning methods were not designed to meet the needs of students at an individual level (Guan, Ma, Liu, Chen & Wang, 2019) which varies based on its application whereas web-based does meet students' needs in the 21st century due to its nature of flexibility and interactivity. According to Bozkurt (2018), traditional learning approaches are typically based on a linear understanding of causality where the same cause leads to the same effect. Hence, the need of web-learning began to gain recognition among students more rapidly since there is evidence of diversification of effects.

WBL provides plenty of academic opportunities for students. These can be viewed from performances, collaborations, achievement as well as interactions. WBL helps in improving student's communication skills, engagement, interaction, and participation in various class activities (Serdyukov&Serdyukova, 2012). In a nutshell, web-based learning practices can be commonly seen in developed and developing nations due to the availability of information technology tools as well as institutional and governmental commitment towards interactive and effective education in the 21st century.

The successful integration of web learning into the educational system has eventually turned the world of teaching and learning into a global village. Currently, more institutions of higher learning around the globe are embracing various forms of web learning in order to provide effective learning opportunities for students. With this new approach of learning that does not have much of facial interaction between teachers or instructors and students who tends to embrace the learning, there is a need to assess students learning experiences of web-based learning being that they play significant role as stakeholders in an educational environment.

Hence, the study objective is;

- i. to assess students learning experiences using web-based learning approach in higher education

2. RELATED LITERATURE

The concept of WBL in education has proven to be learning conducted with the help of web browsers and internet connectivity whereby giving students wider access to learning materials. In modern-day education, the significance of the internet can be traced to providing vital and reliable information, providing a creative environment, enhanced communication, and instructional delivery (Dinc, 2017). WBL stands to provide open access to learning environments (Baragash& Al-Samarraie, 2018). This includes sharing online study materials, participating in online quizzes, examinations, assignments, etc. and receiving a response (feedback) for every action taken in order to improve on students' understanding. Teachers also have the opportunity to build effective and interactive learning materials as well as to conduct various class activities in WBL environments (Scalter, 2008). WBL fosters learner's activities based on individual learning (WBL-IL), collaborative learning (WBL-CL), and instructor-led learning (WEB-ILL).

Individual learning (WBL-IL)

Individuals stand to learn a lot in a WBL classroom. WBL environments are regarded by many scholars as an effective strategy that improves students' high-order thinking (Lin et al, 2020) whereby creating avenues for the students to engage in more interactive learning activities. WBL-IL empowers students to engage more effectively in online search, information retrieval, and educational websites. If these educational websites are fully utilized, they will eventually support learning (Coiro&Fogleman, 2011). Educational websites can be effective tools for learning assessment, good sources of information, and a medium that produces and shares knowledge (Liu, 2017). This mode allows students to freely access course contents, class quiz, examinations, and study resources that can and support their learning.

Collaborative learning (WBL-CL)

In a collaborative web learning environment (WBL-CL), students gain more during web cl with the help of various web tools such as social networks (wikis, podcasts, Facebook, etc.), email, and discussion forums. Collaborative learning is an extensively used instructional technique by which individuals interact in small groups to learn to solve academic problems (Zambrano, et al,

2019). According to Kirschner et al., (2009), collaborative learning can help students overcome individual working memory limitations and facilitate learning effectiveness, efficiency, or both. Results from a previous study show that CL can improve students' scientific learning motivation and learning performance (Hsiao et al, 2017) as well as their learning effectively (Wang, et al, 2017). Zambrano and his colleagues (2019) in a similar study revealed that one sure way of maximizing collaborative learning is to develop collaborative groups to be more effective.

Instructor-led learning (WEB-ILL)

Web-based learning plays an increasing role in higher education as a means of flexible teaching and learning. Educators need to embrace this flexible teaching strategy to better engage students and deliver their learning outcomes. In WEB-ILL, the environment has the advantage of enabling collaborative authoring and role-based production workflows (Ahn et al, 2017). Ahn and his colleagues (2017) concluded that the primary focus of any web tool is to create various activity-based objects for effective learning while the secondary focus involves managing all aspects of live instructor-led classroom activities in a teaching-learning environment. This stands the belief that WBL classrooms are better managed when it is instructor-led since it has more formalized coaching activities (Urick, 2017) and appears to be more optimal than traditional teaching methods (Ding & Zhang, 2018). In a related study, (Onah& Sinclair, 2017) pointed out that the main purpose of the instructor-led approach is to introduce lesson prerequisites that will lead the learners to a specific link containing resources which are associated to their current lesson of study.

3. METHODOLOGY

The study was targeted at the population of students in the institution used as a case study. From the targeted population, a sample of 150-second semester students was randomly selected from a population of 240 students through a stratified sampling technique from three departments (Business, IT, and Journalism department) which were the available departments as at the time when the study was conducted in a tertiary institution in Ghana. The students were randomly selected with the aim of assessing students learning experiences using a web-based learning approach for their class activities. 56 were selected from the Business Administration department, 69 respondents from the IT department while 25 from the Journalism department. The selection of the respondents was done from diploma, undergraduate, and graduate programs.

The research design is quantitative as views from the students were reported. The research study intends to assess students' learning experiences using a web-based learning approach in higher education. The entire study was based on descriptive surveys through which views and opinions were sampled from the respondents (students) as ways of outlining the study objective.

A five-point Likert scale self-structured questionnaire drafted in English was used to collect data from the respondents. As per the questionnaire, it was divided into two (2) sections with Section 1 giving students response to computer knowledge, online learning, and internet access; and Section 2 giving an assessment of students' learning experiences with a web-based learning system. In all, 10 questions were asked. The generated data from the 150 students who responded

to the instrument was collated, organized, and analyzed based on the stated objective using descriptive statistics.

The web toolkit used for this study for enhancing student web learning experiences was Edmodo. This was introduced to the students by the researchers as a safe and simple designed web platform that can be useful in classroom management which is engaging and interactive. As an interactive web platform, Edmodo encourages collaborative learning among students from any location. Sign up on the web toolkit is free for students; teachers as well as parents are expected to monitor the learning processes (Figure 1).

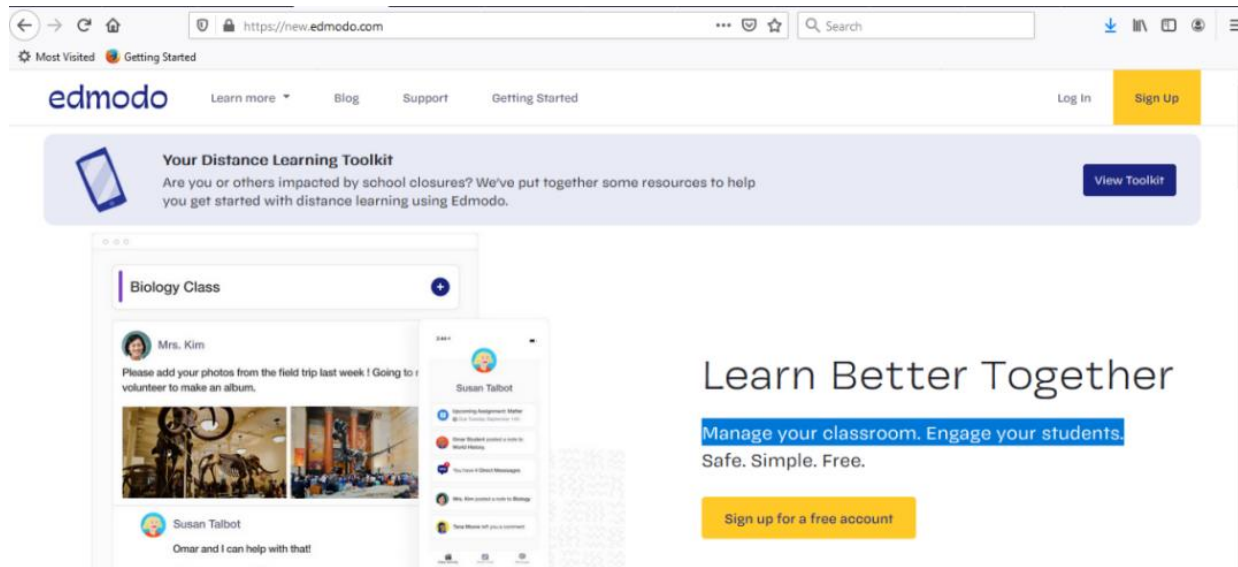


Figure 1: Web learning toolkit (edmodo)

Source: Edmodo (2020)

4. FINDINGS

Demographic Characteristics of Sample

The following table 1 provides a general overview of the teacher and staff demographic information, such as age, gender, educational level, computer knowledge, and internet knowledge, and user experience. The demographic characteristics of respondents presented in Table 1 show those percentages who participated in the study.

Table 1: Demographic Information's of the respondents

S/No.	Variable	Description	Frequency	Percentage	Cumulative Percent
1	Gender	Male	96	64.0	64
		Female	54	36.0	100.0
2	Age	16-25	104	69.3	69.3
		26-35	37	24.7	94.0
		36-45	9	6.0	100.0
3	Program	Diploma	14	8.7	8.7
		Undergraduate	119	79.3	88
		Graduate	18	12.0	100.0
4	Department	Business	56	37.3	37.3
		Admin			
		IT	69	46.0	83.3
		Journalism	25	16.7	100.0
5	Computer knowledge	Poor	11	7.3	7.3
		Moderate	62	41.3	48.6
		Good	46	30.7	79.3
		Very Good	31	20.7	100
6	Online learning	Poor	24	16.0	16.0
		Moderate	76	50.7	66.7
		Good	32	21.3	88.0
		Very Good	18	12.0	100
7	Internet access to information	Poor	3	2.0	2.0
		Moderate	69	46.0	48.0
		Good	47	31.3	79.3
		Very Good	31	20.7	100

As shown in Table 1 above, 64% were male and 36% were female. Also, the age distribution shows more than half of the respondents (69.3%) were aged 16 to 25 and the second group was aged 26 to 35 representing 6%. For the third group, the percentage of the 36 to 45 years was 6% which was the percentage of those who were older than 35 years. Respondents were asked to specify their program in the institute. As shown in Table 1 above, 8.7% registered for the diploma program, 79.3% registered for the undergraduate program, while 12% registered for graduate program degree program. When asked about departments in their respective programs, 37.3% indicated they are in the Business Administration department, 46% indicated the department of IT while 16.7% indicated they are in the Journalism department. As revealed by table 1, 41.3% of the respondents were from the moderate group in terms of computer knowledge, 30.7% of the respondents were good while 20.7% were very good in computer knowledge. A small percentage of the respondents (7.3%) did not have good (poor) computer knowledge. In responding to their experiences in online learning, only 16% reveal that they have

poor online learning experiences over time, while 50.7% have moderate experiences with a cumulative of 33.3% responding to good experiences. A cumulative of 52% indicated that they have access to the internet while 46% express their opinion to be moderate access to the internet. Only about 2% indicate poor access to the internet which represents a very small number of respondents. Based on the above statistical report, we can predict that more of the respondents (students) are aware and have engaged themselves with web related services in their predefined academic tasks over time. Hence, the result shows clearly that the respondent's behavioral intention and technology acceptance interest to use WBL for their class exercises will be effective.

Students learning experience using web-based learning in Higher Education

Some outlined factors (WBL-IL, WBL-CL, and WBL-ILL) stated categorically in a self-structured questionnaire were used as measures in assessing the student's learning experiences with a web-based system. This follows the views of Giannakos M. et al, (2020) stating that assessment of learning largely depends on a standardized questionnaire applied in evaluating learning efficacy. Hence, the following questions as shown in Table 2 below were raised.

Table 2: Statistical rating showing assessment of student learning experiences with web-based learning system

S/No.	Experiences	Strongly Agree (SA)	Agree (A)	Undecided (U)	Disagree (D)	Strongly Disagree (SA)
8	Using of web-based learning encourage me to be more active (Individual learning - WBL-IL)	49 (32.7%)	86 (57.3%)	11 (7.3%)	3 (2%)	1 (0.7%)
9	Using of web-based learning enables me to engage in collaborative learning (WBL-CL)	42 (28%)	91 (60.7%)	9 (6%)	5 (3.3%)	3 (2%)
10	Using of web-based learning provides me with quality instruction (Instructor-led learning - WEB-ILL)	23 (15.3%)	93 (62%)	16 (10.7%)	13 (8.7%)	5 (3.3%)

Keys: Strongly Agree = (SA), Agree = (A), Undecided = (U), Disagree = (D), Strongly Disagree = (SA)

Table 2 above illustrates questions that seek to find responses from students on the impact of a web-based system for learning.

In assessing student learning experiences with WBL, various factors were outlined to determine student's responses which help confirm how effective a web-based learning system could be during learning. Hence, these happen to be statements used in assessing students' learning experiences using a web-based learning approach.

Using of web-based learning encourages me to be more active (Individual learning - WBL-IL)

In responding to WBL-IL, a huge majority of the students, 32.7% strongly agreed with WBL encouraging their individual learning, while 57.3% agreed with WBL encouraging their individual learning activities. 7.3% of the respondents were undecided about the experiences hence they preferred not to agree and disagree on individual learning with WBL. Only 0.7% of the respondents strongly disagreed with WBL having an effect on individual learning while 2% did not agree (disagreed) with WBL encouraging their individual learning. The results revealed that students were able to express their feelings that learning with WBL is an active approach when compared to the traditional learning approach. Although with the large turnout in favor of WBL-IL among the students, 2.7% opposed the decisions of others as they clearly were not in support of the learning approach. But looking at the entire views of the students, it was observed that students practically endorsed WBL.

Using of web-based learning enables me to engage in collaborative learning (WBL-CL)

Seeking views from the students on their learning experiences with WBL-CL, 28% strongly agreed with WBL as a medium of engaging in collaborative learning while 60.7% were in agreement also. With 5.3% disagreeing, 6% were undecided to actually express their experiences if WBL as a medium engages or not in a collaborative learning environment. Although their concerns called for further research, the findings were able to reveal that learning with WBL improves student learning experiences in collaborative learning environments. The implication from the findings shows that WBL is an engaging platform that encourages collaborative learning among students.

Using of web-based learning provides me with quality instruction (Instructor-led learning - WEB-ILL)

In response to the quality of instruction delivered by WBL-ILL, 15.3% strongly agreed with WBL-ILL providing quality instructions that guide their learning activities while a large number (62%) also agreed with WBL-ILL as providing quality instruction. Undecided respondents towards WBL-ILL were 10.7% with 8.7% disagreeing and 3.3% strongly disagreeing with WBL-ILL as providing quality instructions. This might be a reason for some of the respondents having no computer knowledge and online learning experiences over time. The implication of the findings reveals that WBL-ILL makes it easier for students to access and utilize a WBL system.

5. DISCUSSION

The study was aimed at assessing students' learning experiences using WBL for class activities at higher education. The findings revealed that 88.7% of the students who participated in the study were optimistic towards WBL providing an engaging and collaborative learning environment. However, 5.3% were not in support of these views.

About 90% of the students were able to testify after using the web system for learning that WBL is more active towards individual learning in responding to class assignments, quizzes, examinations, etc. These findings are supported by Baragash& Al-Samarraie (2018) who emphasizes that students 'learning from the Web individually (Web-IL) had a positive effect on their performance in terms of final exams and quizzes. And according to Mosharraf&Taghiyareh (2016), WBL-IL plays a vital role in acquiring pertinent contents that aid practice for learning and promotes the completion of online quizzes

A critical focus of any learning approach is set towards delivering quality instruction regardless of the tool used. WBL-ILL stands a chance to prove beyond the thought that it provides learners with quality instructions. Hence, the study reveals that 77.3% in total agreed on WBL-ILL as a means of providing quality instruction which will enable students access the web resources available and obtain information quickly. This finding is in agreement with Baragash& Al-Samarraie (2018) who observed that students over-valued web resources and tools to obtain quick and easy information to assist in their mastery of the course content.

Hence, developers and teachers can now focus on these as some factors that could be seen to have much effect on student learning experiences of a web-based learning platform. Further studies on the exploration of the stated research objective are encouraged to have a wider and clear perspective on the student's learning interest in web-based learning.

6. CONCLUSION

The study was aimed at assessing students' learning experiences in the WBL environment. With Web-based learning, students can experience the ease of learning based on the interactive development in a web system, can improve on their learning performances, enhance students' ability to utilize available learning resources, and enrich their desire to continue learning.

Respectively, the adoption of web-based systems for students learning was a significant boost in strengthening their learning activities and to improve the quality of learning. The study was able to unveil some recommendations for the implementation of web-based systems for learning. Though web-based learning relatively promotes collaborative and interactive mediums for students, it is definitely impossible to adopt such an approach for a class where students haven't heard nor have any experience with web-based systems of instruction. Hence, students need to be abreast with the importance of web-based learning in enhancing their class activities.

7. RECOMMENDATION

The following were recommendation drawn from the study;

- Learning can be made encouraging, interactive, and engaging if institutions do adopt web-based systems as part of their curriculum as a learning approach and as a means of strengthening its usage which will enhance future learning experiences among students as well as organizing regular symposiums on web-based learning practices.
- Constantly providing students with attractive educational content that will cater to their learning abilities. By so doing, it will improve on their adaptive and learning performances with web-based instruction. Such content should be customized to make learning somehow easy for students.

REFERENCES

- Abedi, P., Keshmirshekan, M. H., & Namaziandost, E. (2019). The comparative effect of flipped classroom instruction versus traditional instruction on Iranian intermediate EFL learners' English composition writing. *Journal of Applied Linguistics and Language Research*, 6(4), 43-56.
- Ahn, J. Y., Mun, G. S., Han, K. S., & Choi, S. H. (2017). An online authoring tool for creating activity-based learning objects. *Education and Information Technologies*, 22(6), 3005-3015.
- Ashoori, J., Kajbaf, M. B., Manshaee, G. R., & Talebi, H. (2020). Comparison of the Effectiveness of Web-Based, Cooperative Learning and Traditional Teaching Methods in Achievement Motivation and Academic Achievement in the Biology Course. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, 5(2), 25-34.
- Baragash, R. S., & Al-Samarraie, H. (2018). An empirical study of the impact of multiple modes of delivery on student learning in a blended course. *The Reference Librarian*, 59(3), 149-162.
- Baragash, R. S., & Al-Samarraie, H. (2018). Blended learning: Investigating the influence of engagement in multiple learning delivery modes on students' performance. *Telematics and Informatics*, 35(7), 2082-2098.
- Bozkurt, S. (2018). The Effects of Differential Learning and Traditional Learning Trainings on Technical Development of Football Players. *Journal of Education and Training Studies*, 6, 25-29.
- Chen, J. F., & Huang, H. F. (2018). Empirical Study on the Factors Influencing the Web-based Teaching Effect. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(5), 1635-1643.
- Coiro, J., Fogleman, J., 2011. Using websites wisely. *Educ. Leadership* 68, 34–38 Retrieved from <https://www.learntechlib.org/p/132077>.
- Dinc, E. (2017). Web-based education and accessibility. *International Journal of Technology in Education and Science*, 1(1), 29-35.
- Ding, Y., & Zhang, P. (2018). Practice and effectiveness of web-based problem-based learning approach in a large class-size system: A comparative study. *Nurse education in practice*, 31, 161-164.

Divéki, R. (2018). Teachers' attitudes towards dealing with controversial issues in the EFL classroom: A pilot study (Vol. 12, pp. 27-54). Working Papers in Language Pedagogy.

Edmodo (2020). Your Distance Learning Toolkit: Manage your classroom. Engage your students. Available online at <https://new.edmodo.com/>

EvyNurvitasari, RiyawanSusanto, KhumaerohDwiNur'aini and EtrianaMeirista (2018). The Utilization of Edmodo in Blended Learning. *Advances in Social Science, Education and Humanities Research*, Volume 226, pg. 1427-1434.

Giannakos, M. N., Sharma, K., Papavlasopoulou, S., Pappas, I. O., &Kostakos, V. (2020). Fitbit for learning: Towards capturing the learning experience using wearable sensing. *International Journal of Human-Computer Studies*, 136, 102384.

Gros, B., Garcia, I., &Escofet, A. (2012). Beyond the net generation debate: A comparison of digital learners in face-to-face and virtual universities. *International Review of Research in Open and Distributed Learning*, 13(4), 190-210.

Guan, J., Ma, Z., Liu, Q., Chen, H., & Wang, S. (2019). Design of Personal Learning Management Platform Based on Information Technology. In *Proceedings of the 2019 3rd International Workshop on Education, Big Data and Information Technology* (pp. 79-86).

Hsiao, H. S., Hong, J. C., Chen, P. H., Lu, C. C., & Chen, S. Y. (2017). A five-stage prediction-observation-explanation inquiry-based learning model to improve students' learning performance in science courses. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(7), 3393-3416.

Kirschner, F., Paas, F., & Kirschner, P. A. (2009). Individual and group-based learning from complex cognitive tasks: Effects on retention and transfer efficiency. *Computers in Human Behavior*, 25(2), 306–314. <https://doi.org/10.1016/j.chb.2008.12.008>.

Lin, Y. R., Fan, B., &Xie, K. (2020). The influence of a web-based learning environment on low achievers' science argumentation. *Computers & Education*, 151, 103860.

Liu, B. (2017). Multimedia classroom and innovation of English teaching model based on web-based learning platform. *Revista de la Facultad de Ingenieria*, 32(12), 1000-1006.

Mosharraf, M., &Taghiyareh, F. (2019). Automatic Syllabus-Oriented Remixing of Open Educational Resources Using Agent-Based Modeling. *IEEE Transactions on Learning Technologies*.

Onah, D., & Sinclair, J. (2017). Assessing self-regulation of learning dimensions in a stand-alone MOOC platform.

Orenstein, P. (2014). Understanding the impact of online instruction and blended learning methods for an undergraduate business decision making course. *Journal for Excellence in Business & Education*, 3(2).

Ray, P. P. (2012). Web based e-learning in india: The cumulative views of different aspects. arXiv preprint arXiv:1208.0770.

Sclater, N. (2008). Web 2.0, personal learning environments, and the future of learning management systems. *Research bulletin*, 13(13), 1-13.

Serdyukov, P., & Serdyukova, N. (2012). Time as factor of success in online learning. *Journal of Information Technology and Application in Education*, 1(2), 40-46.

Serhan, D., & Almeqdadi, F. (2020). Students' Perceptions of Using MyMathLab and WebAssign in Mathematics Classroom. *International Journal of Technology in Education and Science*, 4(1), 12-17.

Thamrin, N. S., Suriaman, A., & Maghfirah, M. (2019). Students' perception on the implementation of moodle web-based in learning grammar. *IJOLTL-TL (Indonesian Journal of Language Teaching and Linguistics)*, 4(1), 1-10.

Urlick, M. (2017). Adapting training to meet the preferred learning styles of different generations. *International Journal of Training and Development*, 21(1), 53-59.

Wang, M., Cheng, B., Chen, J., Mercer, N., & Kirschner, P. A. (2017). The use of web-based collaborative concept mapping to support group learning and interaction in an online environment. *The Internet and Higher Education*, 34, 28-40.

Wulandari, G. S. (2018). The Development of Learning Management System Using Edmodo. In *IOP Conference Series: Materials Science and Engineering* (Vol. 336, No. 1, p. 012046). IOP Publishing.

Zacharis, N. Z. (2015). A multivariate approach to predicting student outcomes in web-enabled blended learning courses. *The Internet and Higher Education*, 27, 44-53.

Zambrano, J., Kirschner, F., Sweller, J., & Kirschner, P. A. (2019). Effects of prior knowledge on collaborative and individual learning. *Learning and Instruction*, 63, 101214.

Zhang, J., & Tian, Y. (2019). The Influence of Field Independent-Dependent Cognitive Styles on Students' Learning Performance under Different Teaching Modes. In *Proceedings of the 2019 7th International Conference on Information and Education Technology* (pp. 230-237).

Zhang, X., Zhang, C., Stafford, T. F., & Zhang, P. (2019). Teaching introductory programming to IS students: The impact of teaching approaches on learning performance. *Journal of Information Systems Education*, 24(2), 6.