

Teaching and learning Physical Education in a virtual space: A retrospection

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ABSTRACT

A dramatic change has occurred in the educational scene as a result of the COVID-19 epidemic, which has accelerated the adoption of online learning all across the world. Students, teachers, and educational institutions have all been presented with opportunities and problems as a result of this transformation. In the event of lockdowns or other social distancing measures, online learning provides students with the flexibility, accessibility, and continuity of instruction they require. This study examines the effectiveness of online PE learning during pandemics. It was discovered that teacher and student motivation determine how the learning management system affects physical education instruction. While pedagogical usability includes interactivity, content and resources, multimedia, learning strategy design, and instructional feedback, web usability encompasses navigation, accessibility, consistency, and visual design. The results demonstrated a substantial relationship between web usability, learnability, visual design, pedagogical usability, instructional assessment, and learner guidance and support. Additionally, research demonstrates that student attention and learning relevance are impacted by pedagogical usability, which includes instructional evaluation and learner support and help. Student confidence and relevance are impacted by web usability elements, including navigation, learnability, accessibility, and visual design. This implies that physical education learning can be enhanced by integrating technology with physical activity instruction in a learning management system or e-learning resources.

Keywords: Web usability, pedagogical usability, E-Learning.

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INTRODUCTION

The number of students forced to remain at home because of all levels of education being closed peaked at 1.598 billion from 194 nations on April 1, 2020 (UNESCO 2020). The pandemic has significantly impacted how college students approach their academic work and personal lives (e.g., the shift to online lectures and tutorials, the closure of libraries, the alteration of communication channels for administrative and teacher support, new methods of assessment, varying workloads and performance levels, etc.)(Cao W. et al.), and social life (closed dorms and consequently moving back home, no meetings with friends, peers, or family, no parties, no traveling, staying trapped abroad, etc.) as well as their personal financial situation

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(loss of student job, concerns about their own financial situation, future education and career) and emotional health (fears, frustrations, anxiety, anger, boredom, etc.)

The research proves that a global pandemic is making it more difficult for higher learning institutions. State schools struggled to shift quickly to online learning because they lacked sufficient digital equipment, and their technology was not updated. Most students were unable to access dependable connectivity or equipment they needed for online learning, which made it more challenging for them to perform well at school. In addition, educators struggled to adjust their classes to accommodate virtual platforms. It became challenging and took more time to educate students effectively. This negatively impacted the performance of the school, the students, and the percentage of students who remained enrolled throughout the pandemic. The instructor also frequently thanked the students for their efforts and provided them with constructive criticism. This made them feel proud of themselves and kept them motivated to learn. Even when things turned tough, the students and teacher remained engaged and interested and eager to learn in this open and nurturing environment.

Because of this circumstance, students must learn on their own since they are unable to receive direct instruction from lecturers or teachers (Aminatun & Oktaviani, 2019). Students actually face a number of issues with online learning that capitalize on technological expertise. Students' learning challenges during the teaching and learning process at home are one effect of online learning that can be observed, according to research by Purwanto et al. (2020). When taking part in distant learning, students experience pressure because they feel compelled to do so and because their home infrastructure and resources are insufficient. Ahmad (2016) discovered that EFL learning, which necessitates a great deal of practice, also encountered difficulties in listening sessions when implementing the learning system because teachers' ICT tools, which they use to train students who are dispersed throughout different locations, are frequently ineffective.

During the pandemic, a teacher used interactive tools like quizzes, polls, and breakout rooms in video conferencing platforms to make online lessons engaging. By incorporating real-life examples and encouraging group discussions, the teacher motivated students to actively participate despite being remote. At the same time, the teacher regularly provided positive feedback and recognized students' efforts publicly, which boosted their confidence and motivation to continue learning. This interactive and supportive environment helped maintain enthusiasm and commitment to learning for both the teacher and students during challenging times.

Particularly in higher education, the new "home learning activities-online distance learning" paradigm of the teaching and learning process may offer an alternative viewpoint on an efficient teaching and learning methodology. An effective teaching practice model prior to the COVID-19 pandemic may not be the same as an effective teaching practice model during the pandemic. Additionally, students' preparedness is impacted by the transition from in-person to online instruction (Wulanjani & Indriani, 2021).

PE teachers faced many difficulties as a result of the move to online instruction brought on by the pandemic. With little to no preparation, teachers in physical education—a traditionally neglected topic (Richards et al., 2018)—lacked experience in remote PE instruction and instead used "trial-and-error" methods (Jeong & So, 2020).

Natural disasters, pandemics, conflict, and the rising number of pupils highlight the need for virtual teaching and online learning, as highlighted by zone regions, student discontent (Bartusevičienė et al., 2021), and the growing demand for individualized and lifelong learning. In order to improve education, it is necessary to invest in infrastructure, raise awareness, provide high-quality online courses, train instructors, and address equity issues (Alemán de la Garza, 2019; Turnbull et al., 2021). According to Vaquero-Diego and Vazquez (2022), virtual

teaching has the potential to be a potent instrument for changing education and helping students have life-changing educational experiences.

As the Secretary of the Philippine Department of Education (DepEd), Leonor Briones, once said, "Education must continue even in times of crisis whether it may be a calamity, disaster, emergency, quarantine, or even war" (Department of Education, 2020). The Commission on Higher Education (CHED) of the Philippines, however, recommended that HEIs keep "deploying available flexible learning and other alternative modes of delivery in lieu of on-campus learning" (Commission on Higher Education, 2020). Private HEIs are left to create their own policies; nevertheless, norms and regulations are not implemented.

Because teachers are constantly committed to their students' education, the researcher truly respects and admires everything they do. It's astounding how well teachers are able to manage their time given the new norm of virtual learning. The researcher is aware that physical education (PE) has long been viewed as a subject that emphasizes learning by doing and applying what has been learned in practical settings where it is crucial to be near and touch other people. But the COVID-19 pandemic has changed the way physical education is taught, and this has had a significant impact on PE teachers. Teachers profoundly impact human lives due to the very nature of their profession. They serve as the foundation for students' learning. One of the most important roles teachers play in school is to provide quality education and instill knowledge in their students. Most teachers dedicate significant time to managing paperwork, preparing lessons, and fulfilling their responsibilities for their students. According to numerous studies by Peyton et al., student engagement in online courses is challenging because of the worse teacher-student connection compared to traditional classroom settings. Particularly, PE practical exercises include topics that involve physical activity, enhance personal health and/or physical abilities, alleviate stress, and help people overcome mental obstacles. Actually, physical education lessons aid in the development of motor abilities, foster student cooperation, or stimulate social connections through competitive or group activities. However, because the teacher and the students are geographically and physically separated, online physical education sessions might not offer these educational advantages to the students. However, it is essential to switch to online learning for undergraduate PE during the COVID-19 pandemic.

Statement of the problem

This research aims to determine the motivation to learn of the students and the effectiveness of students in learning physical education. Specifically, this study seeks to answer the following questions:

1. What is the extent of web usability of e-learning attributes in terms of navigation, learnability, accessibility, consistency, and visual design?
2. What is the extent of pedagogical usability of e-learning attributes in terms of instructional design concerning interactivity, content and resources, multimedia use, learning strategies design, instructional feedback, instructional assessment, and learner guidance and support?
3. What is the level of motivation to learn, attention, relevance, confidence, and satisfaction of the students?
4. Is there a significant effect of web usability and pedagogical usability on the level of motivation, attention, relevance, confidence, and satisfaction of the students?

METHODOLOGY

The quantitative research design was applied in this study to investigate teachers' and students' motivation to learn about other state universities and colleges on the use of online tools to enhance their approach to learning. In relation to this, the study also looked at how the online tools can motivate thinking skills. This study further examined students' level of motivation and experiences faced when online tools are used for teaching and learning physical education purposes.

The study is primarily a quantitative research technique in which the researcher administered a survey questionnaire that was validated by educational experts to test its internal accuracy and a Cronbach's alpha indicating a level of reliability for pilot testing, while Multivariate General Linear Model (GLM) and Linear Regression were used to assess the significant effect of usability of instructional design, pedagogical usability, and level of motivation of the students and faculty. The researcher designed and developed a Digital-Based Curriculum Learning Management System that examined students' and teachers' level of motivation in teaching and learning physical education.

The participants of the study were teachers and students at Laguna State Polytechnic University Sta. Cruz, Batangas State University, and University of Rizal System. The students were enrolled in the Academic Year 2024-2025. The main respondents are limited to three hundred thirty-seven (337), consisting of thirty-seven (37) physical education teachers and three hundred (300) physical education students. For the pilot test, there are twelve (12) physical education teachers and one hundred (100) physical education students of Southern Luzon State University. The researcher used simple random sampling to select students who had answered the questionnaire. The study was conducted in state universities of Batangas, Laguna, and Rizal, where the PE teachers are aiming to increase their ability to teach the students during an online class. The piloting was conducted at Southern Luzon State University, where the researcher can easily meet the target sessions of the respondents.

To accomplish the objectives of this research, the study employed different instruments, including a survey on the extent of usability of e-learning and the instructional design of students in learning physical education using an online platform. The instrument used to collect the data was a survey questionnaire using Google Form. This was used because it gathers data faster than any other method, wherein the respondents were PE teachers and students who could read and answer the questionnaire with ease. The draft of the questionnaire was drawn out based on readings and reviewed published and unpublished theses relevant to the study. The researcher ensured that there were enough items to collect data to cover all aspects of the problem and to answer all the specific questions under the statement of the problem. The researcher then submitted the questionnaire to the adviser for correction, after which it was finalized.

The questionnaire was pilot tested for internal consistency. The result of the internal consistency or reliability test for the students' responses is first presented with respect to pedagogical usability. The questionnaire was divided into seven sections: Interactivity, Content and Resources, Multimedia Use, Learning Strategies Design, Instructional Feedback, Instructional Assessment, and Learner Guidance and Support, each containing five items. Cronbach's alpha, a measure of reliability, was calculated for each section to assess how closely related the items were within each category. The reliability test results indicate that the questionnaire is internally consistent and suitable for use without requiring revision. Cronbach's alpha values for all seven sections, namely Interactivity (0.83), Content and Resources (0.72), Multimedia Use (0.77), Learning Strategies Design (0.73), Instructional Feedback (0.76), Instructional Assessment (0.78), and Learner Guidance and Support (0.75), fall within reliable ranges. Since all values are above the commonly accepted threshold of 0.70,

this suggests that the items within each section consistently measure their intended constructs. Interactivity demonstrates strong reliability (above 0.80), while Multimedia Use, Learning Strategies Design, Instructional Feedback, Instructional Assessment, and Learner Guidance and Support are slightly lower, still meeting the acceptable standard. Therefore, the instrument is reliable as it stands and no further revisions are necessary to improve internal consistency. Uusiautti and Maatta (2013) define digital pedagogy as the application of digital resources and technologies to improve educational procedures. It includes many different kinds of activities and methods that make use of digital resources, including educational software and interactive multimedia to produce interesting and successful learning opportunities. The goal of digital pedagogy is to encourage students' critical thinking, active learning, and teamwork by meaningfully incorporating technology into the curriculum. It also entails reconsidering conventional teaching techniques to better fit the digital era, with a focus on individualized learning, accessibility, and the growth of digital literacy abilities. Digital pedagogy is really about utilizing technology to enhance learning outcomes and get kids ready for the 21st-century requirements (Majoka et al., 2013).

The results of the internal consistency or reliability test for the students' responses on web usability are likewise presented in five sections: Navigation, Learnability, Accessibility, Consistency, and Visual Design, each containing five items. Cronbach's alpha was calculated for each section to assess how closely related the items were within each category. The reliability test results indicate that the questionnaire is internally consistent and suitable for use without requiring revision. Cronbach's alpha values for all five sections, namely Navigation (0.76), Learnability (0.71), Accessibility (0.84), Consistency (0.77), and Visual Design (0.77), fall within reliable ranges. Since all values are above the commonly accepted threshold of 0.70, this suggests that the items within each section consistently measure their intended constructs. Accessibility demonstrates strong reliability (above 0.80), while Navigation, Learnability, Consistency, and Visual Design are slightly lower, still meeting the acceptable standard. Therefore, the instrument is reliable as it stands, and no further revisions are necessary to improve internal consistency. Usability and accessibility are used by quality assurance frameworks to highlight the significance of guaranteeing that all students can access and use course materials and activities. According to Microsoft (2016), accessibility is a feature that makes experiences available to everyone. In terms of course design, accessibility features can include utilizing plain language, creating consistent course navigation, permitting accurate captions for multimedia, offering alternate text for images, and guaranteeing compatibility with a range of devices, including assistive technologies.

The results of the internal consistency or reliability test for the students' responses on learning motivation are presented across four sections: Attention, Relevance, Confidence, and Satisfaction, each containing five items. Cronbach's alpha was calculated for each section to assess how closely related the items were within each category. The reliability test results indicate that the questionnaire is internally consistent and suitable for use without requiring revision. Cronbach's alpha values for all four sections, namely Attention (0.78), Relevance (0.84), Confidence (0.84), and Satisfaction (0.85), fall within reliable ranges. Since all values are above the commonly accepted threshold of 0.70, this suggests that the items within each section consistently measure their intended constructs. Relevance, Confidence, and Satisfaction demonstrate strong reliability (above 0.80), while Attention is slightly lower, still meeting the acceptable standard. Therefore, the instrument is reliable as it stands and no further revisions are necessary to improve internal consistency. The Attention, Relevance, Confidence, and Satisfaction (ARCS) was created by Keller in 1987. Strategies to increase student motivation are incorporated into the Motivation Model (quoted in Firat, Yüzer, and Kılınç,

2018). Getting students' attention is the initial tactic, in which delivery techniques like infographics and games must pique students' curiosity and motivation methods, flipped classes, and so forth. Infographics, for example, can increase students' attention and enhance the way that education is delivered (Chicca and Chunta, 2020).

Turning to the pilot test results for faculty responses, the result of the internal consistency or reliability test for the questionnaire on pedagogical usability is likewise presented across seven sections: Interactivity, Content and Resources, Multimedia Use, Learning Strategies Design, Instructional Feedback, Instructional Assessment, and Learner Guidance and Support, each containing five items. Cronbach's alpha was calculated for each section to assess how closely related the items were within each category. The reliability test results indicate that the questionnaire is not consistent and not suitable for use without requiring revision or paraphrase. Cronbach's alpha values for all seven sections, namely Interactivity (0.55), Content and Resources (0.34), Multimedia Use (0.49), Learning Strategies Design (0.36), Instructional Feedback (0.86), Instructional Assessment (0.78), and Learner Guidance and Support (0.72), fall within the unreliable and reliable ranges. Since Instructional Feedback, Instructional Assessment, and Learner Guidance and Support are above the commonly accepted threshold of 0.70, this suggests that the items within these sections consistently measure their intended constructs. Instructional Feedback has strong reliability (above 0.80), while Instructional Assessment and Learner Guidance and Support are slightly lower, still meeting the acceptable standard. Interactivity, Content and Resources, Multimedia Use, Learning Strategies Design, and Design were considered unreliable due to insufficient respondents; therefore, the instrument needs further revisions to improve internal consistency. Technology integration in education refers to the use of digital resources and applications in the teaching and learning process to improve academic results and expedite administrative activities. The goal of this integration is to produce a more individualized, dynamic, and interesting environment by making use of a range of technologies, including educational software as well as internet resources (Chanda and Zohaib, 2024).

The results of the internal consistency or reliability test for the faculty responses on web usability are presented across five sections: Navigation, Learnability, Accessibility, Consistency, and Visual Design, each containing five items. Cronbach's alpha was calculated for each section to assess how closely related the items were within each category. The reliability test results indicate that the questionnaire is internally inconsistent and is not suitable for use without requiring revision. Cronbach's alpha values for all five sections, namely Navigation (0.61), Learnability (0.64), Accessibility (0.73), Consistency (0.58), and Visual Design (0.56), fall within the unreliable and reliable ranges. Since Accessibility is above the commonly accepted threshold of 0.70, this suggests that the items within that section consistently measure their intended constructs. Navigation, Learnability, Consistency, and Visual Design fall in the unreliable range due to insufficient respondents; therefore, the instrument needs further revisions to improve internal consistency. Teachers can design and implement a variety of suggested accessibility strategies. Using the LMS to enable efficient online learning, among the most widely used are the goals of Universal Design for Learning (UDL), which are to make learning more accessible by providing every student with an equal chance at success. UDL allows students to choose and be flexible in course content and how they exhibit knowledge and abilities while utilizing a variety of strategies to keep students interested (CAST, 2018; Mancilla and Frey, 2021; Rao, 2021; TEAL, 2010).

The result of the internal consistency or reliability test for the faculty responses on learning motivation is presented across four sections: Attention, Relevance, Confidence, and Satisfaction, each containing five items. Cronbach's alpha was calculated for each section to assess how closely related the items were within each category. The reliability test results indicate that the questionnaire is internally inconsistent and is not suitable for use and requires

revision. Cronbach's alpha values for all four sections, namely Attention (0.76), Relevance (0.59), Confidence (0.54), and Satisfaction (0.76), fall within the unreliable and reliable ranges. Since Attention and Satisfaction are above the commonly accepted threshold of 0.70, this suggests that the items within these sections consistently measure their intended constructs. Relevance and Confidence fall lower and are interpreted as unreliable due to insufficient respondents; therefore, the instrument needs further revisions to improve internal consistency. Some educators are not prepared for this change. Numerous investigations have shown that the majority of educators are under stress handling ODL, and the transition is being carried out in an aggressive manner (Dhawan and Rieley, 2020). These issues might also have an impact on how satisfied students are. A lot of teachers and students encounter issues including installation and download faults. Additionally, students feel that online instruction is boring, overly theoretical, and requires two-way communication (Kebritchi and colleagues, 2017). Additionally, both teachers and pupils are reported to be ready for the ODL (Affouneh et al., 2020).

The study's main goal was to find out how physical education instructors and students at state universities in Laguna, Batangas, Rizal, and Quezon perceive the teaching and learning processes. Following a thorough validation of the study tool, a questionnaire, the researcher composed an official letter of request. The head of the physical education department was then contacted to request authorization to use digital tools like Google Forms and Facebook Messenger to administer the poll. The researcher used a five-option Likert scale format to guarantee the effectiveness of the questionnaire. Understanding the need for precision and lucidity, the researcher enlisted the help of professionals who carefully examined the items' structure and content. The questionnaire's items were carefully chosen to cover the key concepts in the theoretical framework, more especially the usability factors that affect e-learning learners' motivation to learn, by consulting prior research. Instead of producing an equal number of items for each parameter, these items were grouped based on each one in order to represent the ways in which usability factors impact students' motivation.

Five experts evaluated each item and assigned it to a particular content area to ensure that it consistently conveyed a perceived meaning. In March 2025, the researcher gave out 100 questionnaires to Southern Luzon State University physical education students as part of the pilot testing phase. The students' input was valuable since they had previously interacted with the e-learning platforms that were in use in their classes. Google Forms was used to provide copies of the questionnaires, which respondents could readily complete online. On the same day that they were received, the responses were promptly gathered and combined. The researcher employed Cronbach's Alpha to examine the trustworthiness of the results from the pilot test. Furthermore, a Multiple Linear Regression was utilized to investigate the noteworthy impacts of pedagogical and web usability on the motivation levels of students.

RESULTS AND DISCUSSION

This study examined the web usability, pedagogical usability, and learning motivation of Physical Education faculty and students from select state universities in Region IV-A. The study involved two groups of respondents: 37 faculty members and 300 students. Data were gathered using structured Likert-scale questionnaires organized around key dimensions of web usability, pedagogical usability, and motivational constructs drawn from the ARCS model. Descriptive statistics, including weighted means and standard deviations, were computed to characterize the level of agreement across all indicators, while a multivariate general linear model (GLM) and multiple linear regression analysis were employed to determine the effects

of usability factors on students' motivation. The discussion that follows is grounded entirely in the data gathered and interprets the results in direct relation to the objectives of the study.

Web usability of Physical Education faculty

The web usability of e-learning materials as perceived by faculty members was assessed across five dimensions: navigation, learnability, accessibility, consistency, and visual design. Across all five dimensions, faculty respondents expressed strong agreement with every indicator, with all overall dimension means falling within the range interpreted as strongly agree and very applicable.

In the dimension of navigation, faculty respondents strongly agreed with all five indicators, yielding an overall mean of 4.80 with a standard deviation of 0.39, interpreted as very applicable. The indicator pertaining to easy-to-understand language received the highest mean of 4.92 with a standard deviation of 0.28, reflecting strong faculty agreement that clear and straightforward language significantly enhances the learning experience and ensures that learners across varying backgrounds and proficiency levels can grasp concepts efficiently without unnecessary confusion. The remaining indicators, covering ease of use, use of ample white space and color changes, and the number of clicks required to access information, received means ranging from 4.78 to 4.86, all interpreted as strongly agree, indicating comprehensive satisfaction with navigational design. The indicator for quick processing of commands received the lowest mean of 4.62 with a standard deviation of 0.49, though it remained within the strongly agree category, reflecting overall satisfaction with system responsiveness. These results align with the observation of Linder-VanBerschot and Summers (2015) that online learning requires teachers to actively provide accessible and autonomy-supporting resources, and with Alexander's (2017) assertion that higher education institutions can foster digital competence in faculty by enabling them to experiment with and learn to use technological tools effectively.

In the dimension of learnability, all indicators were rated under the strongly agree category, producing an overall mean of 4.77 with a standard deviation of 0.38, interpreted as very applicable. The indicator stating that the material includes instructions that are easy to comprehend received the highest mean of 4.95 with a standard deviation of 0.23, indicating near-unanimous agreement that comprehensible instructions substantially enhance learner effectiveness and experience. The indicators for clear primary actions and ease of familiarization yielded means of 4.92 with a standard deviation of 0.28 and 4.76 with a standard deviation of 0.43 respectively, while the indicator for good features received a mean of 4.73 with a standard deviation of 0.45, all rated as strongly agree. The indicator addressing how the material helps novice users learn quickly and facilitates steady advancement to expertise received the lowest mean of 4.51 with a standard deviation of 0.51, still interpreted as strongly agree, but comparatively lower, suggesting that while faculty are satisfied with the learnability of the materials, the scaffolding provided for novice users and progressive skill-building may warrant further enhancement. The Nielsen Norman Group (2020) has identified learnability as one of the five quality components of usability, noting that it captures how quickly users can become accustomed to an interface on first interaction and how many attempts it takes to achieve proficiency. The faculty ratings affirm that the e-learning materials largely satisfy this criterion.

In the dimension of accessibility, faculty respondents again strongly agreed with all indicators, yielding an overall mean of 4.74 with a standard deviation of 0.47, interpreted as very applicable. The indicator affirming that the material is sensible, meaningful, and usable for as many people as possible received the highest mean of 4.84 with a standard deviation of 0.37, underscoring faculty recognition that content addressing diverse learners' needs and real-

world applications enhances motivation and retention. The indicators for understandability and perceivability received means of 4.81 with a standard deviation of 0.40 and 4.78 with a standard deviation of 0.42 respectively. The indicators for content or functionality available to students with special needs in the sense of sight and for correct and organized headings both received the lowest mean of 4.62, with standard deviations of 0.68 and 0.49 respectively, yet both remained within the strongly agree category. Tang et al. (2021) have noted that effective website design requires knowledge of web accessibility challenges and that the design of a website determines whether individuals with impairments can perceive its content, a consideration that lends particular significance to the relatively lower but still high scores for special-needs accessibility.

In the dimension of consistency, all indicators were rated under the strongly agree category, producing an overall mean of 4.68 with a standard deviation of 0.49, interpreted as very applicable. The indicator affirming that materials use only one language received the highest mean of 4.89 with a standard deviation of 0.31, reflecting faculty recognition that the use of a single language simplifies content development and ensures consistency while impacting accessibility and inclusivity. The indicators for same colors and combinations and same icons for linked themes received means of 4.68 with a standard deviation of 0.47 and 4.70 with a standard deviation of 0.46 respectively. Horizontal and vertical spacing between elements yielded a mean of 4.59 with a standard deviation of 0.60, while the use of same size of texts and images received the lowest mean of 4.54 with a standard deviation of 0.61, though both remained strongly agree. Cyr (2008), Coursaris and Van Osh (2016), Garrett et al. (2016), and Post et al. (2017) have collectively established that visual design elements including color, contrast, image size, font, and typography contribute to visually appealing and emotionally positive user experiences, and the strong ratings across consistency indicators affirm that the evaluated materials largely satisfy these design expectations.

In the dimension of visual design, faculty respondents strongly agreed with all five indicators, producing an overall mean of 4.70 with a standard deviation of 0.51, interpreted as very applicable. The indicators for possession of line art or simple illustrations and for lightness or darkness of color both received the highest mean of 4.78 with a standard deviation of 0.42, reflecting faculty agreement that expressive illustrations and contrast in color ensure visual distinguishability and support memory retention by providing clear visual cues. The indicators for a mix of shapes and lines for detailed illustrations and for whitespace or negative space both received means of 4.76 with a standard deviation of 0.43. The indicator for three-dimensional objects received the lowest mean of 4.43 with a standard deviation of 0.83, still within the strongly agree category, but the relatively larger standard deviation suggests greater variability in faculty assessments of three-dimensional design elements. Nielsen Norman Group (2017a) has recognized that visual design significantly influences users' attitudes and behaviors toward websites, and the faculty responses confirm that the visual design of the evaluated e-learning materials is perceived as clear, aesthetically pleasing, and effective in supporting the learning experience.

Pedagogical usability of Physical Education faculty

The pedagogical usability of the e-learning materials as perceived by faculty members was assessed across seven dimensions: interactivity, content and resources, multimedia use, learning strategies design, instructional feedback, instructional assessment, and learner guidance and support. Faculty respondents expressed strong agreement with all indicators across all seven dimensions.

In the dimension of interactivity, all indicators were rated as strongly agree, yielding an overall mean of 4.77 with a standard deviation of 0.39, interpreted as very applicable. The indicator affirming compatibility with mobile devices, whether Android or iOS, received the highest mean of 4.92 with a standard deviation of 0.28, indicating near-unanimous faculty agreement that mobile compatibility significantly enhances user engagement by allowing learners to access content seamlessly across devices. The indicators for incorporation of quizzes, polls, and stories and for resources used in videos and images that complement the content received means of 4.86 with a standard deviation of 0.35 and 4.89 with a standard deviation of 0.31 respectively. The indicator for animations and interactive scrolling yielded a mean of 4.59 with a standard deviation of 0.50, while the indicator for requesting feedback from the audience received the lowest mean of 4.57 with a standard deviation of 0.50, though both remained within the strongly agree category. Al-Fraihat et al. (2020), Oakes (2002), and Watson and Watson (2012) have established that an LMS fosters engagement and student success by enabling communication tools, interactive features, and varied assessment materials, and the faculty ratings affirm that these elements are well-implemented in the evaluated materials.

In the dimension of content and resources, all indicators were rated under the strongly agree category, producing an overall mean of 4.81 with a standard deviation of 0.37, the highest overall mean among the seven pedagogical dimensions for faculty. The indicator affirming that content offers useful information regarding a particular subject received the highest mean of 4.95 with a standard deviation of 0.23, reflecting faculty recognition that informative content empowers individuals to expand their knowledge and apply it in meaningful ways. The indicator for references to cited literature received a mean of 4.92 with a standard deviation of 0.28, and the indicators for variety of helpful links and for text, images, sounds, videos, and animations both yielded means of 4.78 with a standard deviation of 0.42. The indicator for hyperlinks providing definitions for unfamiliar words received the lowest mean of 4.62 with a standard deviation of 0.49, remaining within the strongly agree category. Leahy, Hanham, and Sweller (2020) have supported the organization of material into manageable segments as a strategy for reducing cognitive overload and improving engagement and comprehension, a principle that faculty recognition of well-structured content effectively reflects.

In the dimension of multimedia use, all indicators fell under the strongly agree category, yielding an overall mean of 4.79 with a standard deviation of 0.36, interpreted as very applicable. The indicators for inclusion of explainer videos, demos, live videos, presentations, testimonials, and interviews and for inclusion of images, icons, and infographics both received the highest mean of 4.95 with a standard deviation of 0.23, indicating near-unanimous faculty agreement that these multimedia elements substantially heighten engagement, maintain learner interest and motivation, and support retention. The indicator for downloadable files for reference received a mean of 4.86 with a standard deviation of 0.35, while the indicator for links providing access to videos and other online content yielded a mean of 4.62 with a standard deviation of 0.49. The indicator allowing users to upload images, videos, and files received the lowest mean of 4.59 with a standard deviation of 0.50, still within the strongly agree category. The use of signaling strategies to draw attention to key information and reduce unnecessary cognitive load, as reflected in these multimedia ratings, has been shown in the literature to improve knowledge retention in multimedia environments.

In the dimension of learning strategies design, all indicators were strongly agreed upon, producing an overall mean of 4.66 with a standard deviation of 0.44, interpreted as very applicable. The indicator affirming that modules and articles are available for download received the highest mean of 4.89 with a standard deviation of 0.31, indicating strong faculty recognition that downloadable modules enhance supplementary learning access and support independent study. The indicators for provision of feedback and praise and for quizzes that

offer explanations yielded means of 4.73 with a standard deviation of 0.45 and 4.70 with a standard deviation of 0.46 respectively. The indicator for explanations or meanings of unfamiliar terms received a mean of 4.62 with a standard deviation of 0.49, while the indicator for note-taking, studying, and test-taking strategies received the lowest mean of 4.38 with a standard deviation of 0.49, still within the strongly agree category but comparatively lower, suggesting that the integration of study skills and metacognitive strategy support is an area where further development could strengthen the pedagogical design. Ivanovic et al. (2018) have emphasized the need to improve and modernize educational practices through technology-enhanced learning frameworks, a view that the faculty ratings affirm in recognizing the strong learning strategy design of the evaluated materials.

In the dimension of instructional feedback, all indicators were rated under the strongly agree category, yielding an overall mean of 4.70 with a standard deviation of 0.45, interpreted as very applicable. The indicator affirming that materials provide rubrics and a pointing system for reflections received the highest mean of 4.86 with a standard deviation of 0.35, reflecting faculty recognition that structured rubrics help learners understand grading criteria, reduce anxiety, and promote focused reflective practice. The indicators for incorporation of intervention for failing scores and for giving chances to failing scores received means of 4.73 with a standard deviation of 0.45 and 4.70 with a standard deviation of 0.46 respectively. The indicators for timely feedback and for compliments and supplemental modules both received the lowest mean of 4.59 with a standard deviation of 0.50, remaining within the strongly agree category. The Educational Endowment Foundation (2021) and Trzesniewski et al. (2021) have collectively emphasized that effective feedback requires deliberate consideration of cognitive, emotional, motivational, and self-regulatory processes, and that task type and classroom environment must be intentionally prepared to support feedback reception and implementation. The faculty ratings reflect recognition of these principles in the design of the evaluated materials, though the relatively lower scores for timely feedback suggest a potential area for refinement.

In the dimension of instructional assessment, all indicators were strongly agreed upon, producing an overall mean of 4.72 with a standard deviation of 0.49, interpreted as very applicable. The indicators for allowing students to answer exercises and for allowing students to reflect on the day's lesson both received the highest mean of 4.86 with a standard deviation of 0.35, indicating faculty agreement that exercise-based and reflective assessment features substantially enhance the educational experience by promoting active engagement, critical thinking, and personalized learning. The indicator for allowing students to make and answer polls received a mean of 4.78 with a standard deviation of 0.42, while the indicator for mind-games activities yielded a mean of 4.65 with a standard deviation of 0.48. The indicator allowing students to post questions received the lowest mean of 4.43 with a standard deviation of 0.83, remaining within the strongly agree category but with a notably larger standard deviation indicating greater variability in faculty assessment of this feature. Beneroso and Robinson (2022), Heisig and Matthewes (2022), Sanjaya (2022), and Fung et al. (2022) have each proposed distinct assessment methodologies for online learning environments, and the strong faculty ratings for assessment features affirm the perceived effectiveness of the assessment design in the evaluated materials.

In the dimension of learner guidance and support, all indicators were rated under the strongly agree category, yielding an overall mean of 4.66 with a standard deviation of 0.50, interpreted as very applicable. The indicators for providing relevant information prior to enrollment and for still accepting late submission of output both received the highest mean of 4.76 with a standard deviation of 0.43, reflecting faculty recognition that pre-enrollment clarity

and flexible submission policies enhance the educational experience by promoting flexibility, equity, and continuous learning. The indicator for providing continuing support, advice, and counseling throughout the learning process received a mean of 4.68 with a standard deviation of 0.47. The indicators for counseling and advice in relation to the subject and for accepting late responses in quizzes and polls both received the lowest mean of 4.57, with standard deviations of 0.50 and 0.65 respectively, both within the strongly agree category. Symeonides and Childs (2015) have affirmed that students benefit greatly from having instant access to vital support throughout their educational journey, a principle reflected in the strong faculty recognition of learner guidance and support features.

Level of motivation of Physical Education faculty

The learning motivation of faculty members was assessed across four dimensions: attention, relevance, confidence, and satisfaction. Faculty respondents strongly agreed with all indicators across all four dimensions, reflecting consistently high levels of motivation.

In the dimension of attention, all indicators yielded a strongly agree rating, producing an overall mean of 4.61 with a standard deviation of 0.52, interpreted as very applicable. The indicator affirming that respondents find themselves reflecting on the activities received the highest mean of 4.81 with a standard deviation of 0.40, highlighting that reflective engagement fosters deeper self-awareness about progress and challenges, connecting experiences with learning objectives and fostering intrinsic motivation. The indicators for finding oneself further exploring the topic, participating in video discussions, and performing activities of one's own will received means of 4.46 with a standard deviation of 0.61, 4.76 with a standard deviation of 0.43, and 4.70 with a standard deviation of 0.57 respectively. The indicator for enjoying answering the assessments received the lowest mean of 4.32 with a standard deviation of 0.58, still within the strongly agree category. Chen and Wang (2017), Chen et al. (1999), Garn (2017), and Ottundo and Garn (2019) have collectively identified novelty, attention demand, enjoyment, challenge, and exploration as sources of situational interest that a physical education instructor can cultivate to achieve desired motivational outcomes, and the faculty ratings confirm that these sources are meaningfully present in the evaluated learning context.

In the dimension of relevance, all indicators were rated as strongly agree, producing an overall mean of 4.80 with a standard deviation of 0.40, interpreted as very applicable. The indicator affirming that the material is important because it engages respondents with the content and the learning process received the highest mean of 4.92 with a standard deviation of 0.28, reflecting faculty recognition that relevant, relatable, and interactive content encourages active participation and deeper investment in learning. The indicators for finding the material essential, for finding it important as a way of getting subject information, and for finding it important as a way of submitting outputs received means of 4.81 with a standard deviation of 0.40, 4.78 with a standard deviation of 0.42, and 4.76 with a standard deviation of 0.43 respectively. The indicator for finding the material important as the bank of the subject received the lowest mean of 4.73 with a standard deviation of 0.45, still within the strongly agree category. Sinatra et al. (2015) have identified behavioral, cognitive, and emotional engagement as multidimensional components of student involvement, and the strong relevance ratings affirm that faculty perceive the materials as meaningfully addressing all these dimensions.

In the dimension of confidence, all indicators were rated under the strongly agree category, producing the highest overall mean among the four motivational dimensions at 4.87 with a standard deviation of 0.29, interpreted as very applicable. The indicator affirming that respondents acquired more knowledge about the subject received a perfect mean of 5 with a standard deviation of 0, indicating unanimous agreement among all 37 faculty respondents that

the e-learning materials effectively fostered knowledge acquisition. The indicator for increased engagement with the subject received a mean of 4.92 with a standard deviation of 0.28, feelings being valued through reflection yielded a mean of 4.86 with a standard deviation of 0.35, and opinions being appreciated through interactive discussion received a mean of 4.84 with a standard deviation of 0.37. The indicator for attitudes being appreciated through open letter suggestions received the lowest mean of 4.73 with a standard deviation of 0.45, remaining within the strongly agree category. Bandura (1977) and Clark et al. (2008) have defined self-confidence as the belief in one's own performance, and Rubio (2021) has further identified it as a sense of competence essential for managing day-to-day challenges. The faculty ratings, anchored by a perfect score on knowledge acquisition, affirm that the e-learning experience meaningfully strengthens faculty confidence and self-assurance.

In the dimension of satisfaction, all indicators yielded a strongly agree rating, producing an overall mean of 4.86 with a standard deviation of 0.25, interpreted as very applicable. The indicators for increased knowledge with the help of the material and for ideas becoming relevant through interactive discussions both received perfect means of 5 with a standard deviation of 0, indicating unanimous faculty satisfaction with knowledge growth and the relevance-building function of interactive discussions. The indicator for opinions becoming relevant through compliments and feedback received a mean of 4.84 with a standard deviation of 0.37, while the indicator for needs on the subject matter being fulfilled yielded a mean of 4.78 with a standard deviation of 0.42. The indicator for feelings getting fulfilled through compliments and feedback received the lowest mean of 4.70 with a standard deviation of 0.46, still within the strongly agree category. Stack (2015) has established that learning outcomes in online settings can be comparable to those in traditional classrooms, and the uniformly high satisfaction ratings among faculty affirm this equivalence in the evaluated context.

Effects of web usability and pedagogical usability on students' motivation according to faculty members

A multivariate general linear model (GLM) was conducted to investigate the effects of web usability factors and pedagogical usability factors on students' motivation levels as perceived by faculty members. For the web usability sub-dimensions, including navigation, learnability, accessibility, consistency, and visual design, no statistically significant effects were found. Navigation yielded Wilks' Lambda = 0.716, $F(4, 284) = 2.08$, $p = .119$, partial $\eta^2 = .284$; learnability yielded Wilks' Lambda = 0.654, $F(4, 284) = 2.77$, $p = .054$, partial $\eta^2 = .346$; accessibility yielded Wilks' Lambda = 0.694, $F(4, 284) = 2.31$, $p = .091$, partial $\eta^2 = .306$; consistency yielded Wilks' Lambda = 0.815, $F(4, 284) = 1.19$, $p = .342$, partial $\eta^2 = .185$; and visual design yielded Wilks' Lambda = 0.731, $F(4, 284) = 1.93$, $p = .142$, partial $\eta^2 = .269$. All p-values exceeded the 0.05 threshold, leading to the acceptance of the null hypothesis for all five-web usability sub-dimensions, indicating that these factors did not have a statistically significant effect on motivation as perceived by faculty.

Among the pedagogical usability sub-dimensions, similar non-significant results were obtained for interactivity, which yielded Wilks' Lambda = 0.810, $F(4, 284) = 1.23$, $p = .327$, partial $\eta^2 = .190$; content and resources, which yielded Wilks' Lambda = 0.955, $F(4, 284) = .245$, $p = .910$, partial $\eta^2 = .045$; multimedia use, which yielded Wilks' Lambda = 0.995, $F(4, 284) = .027$, $p = .998$, partial $\eta^2 = .005$; learning strategies design, which yielded Wilks' Lambda = 0.949, $F(4, 284) = .280$, $p = .888$, partial $\eta^2 = .051$; instructional feedback, which yielded Wilks' Lambda = 0.949, $F(4, 284) = .279$, $p = .888$, partial $\eta^2 = .051$; and learner guidance and support, which yielded Wilks' Lambda = 0.809, $F(4, 284) = 1.24$, $p = .326$, partial $\eta^2 = .191$.

All p-values exceeded 0.05, leading to the acceptance of the null hypothesis for each of these sub-dimensions.

The sole exception was instructional assessment, which yielded Wilks' Lambda = 0.511, $F(4, 284) = 5.03$, $p = .005$, partial $\eta^2 = .489$. This result was statistically significant at the 0.05 level of significance, leading to the rejection of the null hypothesis and the acceptance of the alternative hypothesis, indicating that instructional assessment had a statistically significant effect on students' motivation. The partial eta squared value of .489 denotes a large effect size, highlighting the substantial influence of instructional assessment on motivational outcomes as perceived by faculty. Chen et al. (2020) have established that assessment procedures significantly impact the accomplishment of educational objectives, and the present finding affirms this relationship in the context of online physical education, underscoring that well-designed formative and summative assessment mechanisms are central to sustaining and enhancing student motivation.

The tests of between-subjects effects further identified which specific motivational components were influenced by each usability factor. The corrected models for all four dependent variables were statistically significant: attention yielded $F(12, 24) = 3.313$, $p = .005$, $R^2 = .624$, adjusted $R^2 = .435$; relevance yielded $F(12, 24) = 2.409$, $p = .026$, $R^2 = .545$, adjusted $R^2 = .320$; confidence yielded $F(12, 24) = 3.723$, $p = .003$, $R^2 = .651$, adjusted $R^2 = .476$; and satisfaction yielded $F(12, 24) = 4.194$, $p = .001$, $R^2 = .677$, adjusted $R^2 = .516$. Within these models, learnability as a web usability factor had a significant positive effect on attention, $F(1, 24) = 11.954$, $p < .002$, $\eta^2 = .332$; consistency as a web usability factor significantly influenced confidence, $F(1, 24) = 4.923$, $p < .036$, $\eta^2 = .170$; and learner guidance and support as a pedagogical usability factor significantly affected satisfaction, $F(1, 24) = 8.226$, $p = .008$, $\eta^2 = .255$.

A multiple linear regression analysis was subsequently conducted to determine which usability components most significantly predicted specific motivational outcomes. Learnability as a web usability factor significantly predicted attention, with $B = 1.177$, $SE = .340$, $t = 3.457$, $p = .002$, partial $\eta^2 = .332$. Visual design as a web usability factor significantly predicted confidence, with $B = 0.376$, $SE = .170$, $t = 2.219$, $p = .036$, partial $\eta^2 = .093$. Instructional assessment as a pedagogical usability factor significantly predicted satisfaction, with $B = 0.406$, $SE = .142$, $t = 2.868$, $p < .008$, partial $\eta^2 = .252$. These findings collectively demonstrate that faculty members perceive the learnability of the platform, the quality of its visual design, and the soundness of its instructional assessment design as the key contributors to students' motivation in an online physical education environment. Costley and Lange (2016) have established that the identification of learning objectives and the effective delivery of content through varied resources substantially impact students' performance and satisfaction levels, a principle that the regression results confirm in the specific context of e-learning-based physical education.

Web usability of Physical Education students

The web usability of e-learning materials as perceived by students was assessed across five dimensions: navigation, learnability, accessibility, consistency, and visual design, involving 300 student respondents. Unlike the uniformly strong agreement observed among faculty, student ratings across several dimensions showed slightly lower means, though all overall dimension means remained within the strongly agree and very applicable range, with the exception of consistency, which was rated as very applicable within the strongly agree range.

In the dimension of navigation, students produced an overall mean of 4.41 with a standard deviation of 0.56, interpreted as strongly agree and very applicable. The indicator for

easy-to-understand language received the highest mean of 4.44 with a standard deviation of 0.55, reflecting student agreement that clear language enhances comprehension across diverse backgrounds and proficiency levels. The indicators for use of ample white space and color changes and for quick processing of commands received means of 4.42 with a standard deviation of 0.53 and 4.40 with a standard deviation of 0.57 respectively. The indicators for ease of use and for taking only a few clicks to get information both received the lowest mean of 4.38, with standard deviations of 0.60 and 0.54 respectively, both within the strongly agree category. Punchoojit and Hongwarittorn (2017) identified navigation patterns, including link navigation, content navigation, and menu navigation, as among the most studied categories in mobile user interface research, affirming the centrality of effective navigational design to the student experience.

In the dimension of learnability, the overall mean was 4.47 with a standard deviation of 0.54, interpreted as strongly agree and very applicable. The indicators for instructions easy to comprehend and for helping novice users learn quickly and facilitating steady advancement to expertise both received the highest mean of 4.49, with standard deviations of 0.55 and 0.52 respectively, indicating student recognition that clear instructional guidance supports smooth learning curves and progressive skill development. The indicator for good features yielded a mean of 4.47 with a standard deviation of 0.53, while the indicators for very clear primary actions and for ease of familiarization both received the lowest mean of 4.44, with standard deviations of 0.57 and 0.53 respectively, both within the strongly agree category. Sousa and Martins (2021) have described learning as a complex activity involving different stages each with multiple tasks and emotions, and have identified comprehension of how humans learn as crucial to developing meaningful products and experiences, a perspective that contextualizes the strong student recognition of the e-learning materials' learnability.

In the dimension of accessibility, students yielded an overall mean of 4.51 with a standard deviation of 0.56, interpreted as strongly agree and very applicable, the highest among the five web usability dimensions for students. The indicator affirming that the material is sensible, meaningful, and usable for as many people as possible received the highest mean of 4.55 with a standard deviation of 0.54, reflecting student recognition of the material's inclusivity and organizational clarity. The indicators for understandability, availability to students with special needs in the sense of sight, and correct and organized headings received means of 4.49 with a standard deviation of 0.59, 4.52 with a standard deviation of 0.54, and 4.53 with a standard deviation of 0.56 respectively. The indicator for perceivability received the lowest mean of 4.47 with a standard deviation of 0.55, still within the strongly agree category. Fgee et al. (2019) have established that accessible websites without obstacles to access are more likely to display correctly on all devices and browsers, and that adherence to accessibility standards ultimately reduces maintenance costs while improving reach, a perspective that aligns with the strong student accessibility ratings.

In the dimension of consistency, students produced an overall mean of 4.35 with a standard deviation of 0.60, interpreted as strongly agree and very applicable, representing the lowest overall mean among the five web usability dimensions for students. The indicator for same icons employed for linked themes received the highest mean of 4.39 with a standard deviation of 0.58, indicating that icon consistency reduces cognitive load and enhances usability. The indicators for horizontal and vertical spacing between elements and for materials using only one language received means of 4.37 with a standard deviation of 0.57 and 4.36 with a standard deviation of 0.57 respectively. The indicators for same colors and combinations throughout the material and for same size of texts and images both received the lowest mean of 4.32, with standard deviations of 0.66 and 0.60 respectively, both within the strongly agree

category but with somewhat larger standard deviations indicating greater variability in student assessments of color and text-image size consistency. The relatively lower overall mean for consistency among students, compared to the 4.68 reported by faculty, may reflect differing levels of sensitivity to visual design coherence between the two groups.

In the dimension of visual design, the overall mean was 4.43 with a standard deviation of 0.56, interpreted as strongly agree and very applicable. The indicator for whitespace or negative space received the highest mean of 4.51 with a standard deviation of 0.56, indicating student recognition that whitespace improves visual hierarchy, reduces cognitive load, and facilitates information processing and retention. The indicator for lightness or darkness of color received a mean of 4.46 with a standard deviation of 0.53, while the indicators for line art or simple illustrations and for mix of shapes and lines both yielded means of 4.41, with standard deviations of 0.57 and 0.56 respectively. The indicator for three-dimensional objects received the lowest mean of 4.34 with a standard deviation of 0.55, still within the strongly agree category. Almaiah et al. (2019) have established that mobile learning systems with excellent design interfaces are more effective and user-friendly, and that well-designed user interfaces enable students to find functions with ease, enhancing satisfaction. The student visual design ratings affirm these principles, though the lower rating for three-dimensional objects, consistent with the faculty rating for the same indicator, suggests a dimension of visual complexity that may require further integration into the materials.

Pedagogical usability of Physical Education students

The pedagogical usability of the e-learning materials as perceived by students was assessed across seven dimensions: interactivity, content and resources, multimedia use, learning strategies design, instructional feedback, instructional assessment, and learner guidance and support.

In the dimension of interactivity, the overall mean was 4.16 with a standard deviation of 0.63, interpreted as agree and moderately applicable, the only pedagogical usability dimension for students to fall below the strongly agree threshold. The indicator for mobile device compatibility, whether Android or iOS, received the highest mean of 4.25 with a standard deviation of 0.61, the only indicator in this dimension to reach the strongly agree level, indicating student recognition that mobile accessibility promotes flexibility and supports diverse learning environments. The indicators for animations and interactive scrolling, resources for videos and images complementing the content, and feedback from the audience received means of 4.16 with a standard deviation of 0.61, 4.17 with a standard deviation of 0.59, and 4.14 with a standard deviation of 0.67 respectively, all within the agree category. The indicator for incorporation of quizzes, polls, and stories received the lowest mean of 4.09 with a standard deviation of 0.66, within the agree category. The comparatively lower student ratings for interactivity relative to faculty may reflect students' more direct experience with the practical limitations of interactive features, such as inconsistencies in quiz functionality or animation performance. Gasevic, Dawson, and Siemens (2015) and Reich (2015) have observed that interactivity is seldom comprehensively assessed in LMS contexts, where analytics typically focus on task completion and risk identification rather than on interactive learning quality, a limitation that the student ratings implicitly reflect.

In the dimension of content and resources, the overall mean was 4.33 with a standard deviation of 0.58, interpreted as strongly agree and very applicable. The indicator for variety of helpful links optimized for relevant keywords received the highest mean of 4.38 with a standard deviation of 0.60, reflecting student recognition that supplementary links provide access to articles, videos, and external resources that deepen understanding and support diverse learning preferences. The indicators for text, images, sounds, videos, and animations relating

to the topic and for references to cited literature received means of 4.36 with a standard deviation of 0.57 and 4.33 with a standard deviation of 0.59 respectively. The indicator for useful information regarding a particular subject yielded a mean of 4.30 with a standard deviation of 0.58, while the indicator for hyperlinks providing definitions for unfamiliar words received the lowest mean of 4.27 with a standard deviation of 0.59, both within the strongly agree category. Banna et al. (2015) have affirmed that while content was previously central to online learning, engagement is now recognized as equally crucial, and Bernard et al. (2009) have identified student-content, student-instructor, and student-student interaction as fundamental techniques for enhancing engagement. The student ratings affirm that content and resources effectively support these engagement dimensions.

In the dimension of multimedia use, the overall mean was 4.25 with a standard deviation of 0.54, interpreted as strongly agree and very applicable. The indicator for allowing users to upload images, videos, and files received the highest mean of 4.32 with a standard deviation of 0.54, indicating student appreciation for the capacity to submit diverse multimedia assignments that enhance creativity and expression. The indicators for downloadable files for reference and for links providing access to videos and other content online both received means of 4.28, with standard deviations of 0.56 and 0.54 respectively. The indicator for explainer videos, demos, live videos, presentations, testimonials, and interviews received a mean of 4.21 with a standard deviation of 0.59, while the indicator for images, icons, and infographics received the lowest mean of 4.19 with a standard deviation of 0.50, falling within the agree category. Huang et al. (2020) and Powell et al. (2015) have established that online courses can utilize animations, simulations, videos, audio, documents, and interactive content to engage students effectively, and that adaptable and personalized content allows learners to bypass mastered material and receive direct feedback on activities. The student multimedia ratings largely affirm these benefits, though the lower rating for images and infographics suggests a specific area where visual enrichment could further strengthen the materials.

In the dimension of learning strategies design, the overall mean was 4.40 with a standard deviation of 0.62, interpreted as strongly agree and very applicable. The indicator for modules and articles available for download received the highest mean of 4.45 with a standard deviation of 0.57, reflecting student recognition that downloadable resources support personalized study approaches and allow revisiting of challenging topics. The indicator for explanations or meaning of unfamiliar terms yielded a mean of 4.42 with a standard deviation of 0.65, and the indicator for quizzes that offer explanations received a mean of 4.41 with a standard deviation of 0.57. The indicator for note-taking, studying, and test-taking strategies yielded a mean of 4.40 with a standard deviation of 0.63, while the indicator for feedback and praise received the lowest mean of 4.32 with a standard deviation of 0.69, within the strongly agree category but with the largest standard deviation in this dimension, indicating greater variability in student assessments of feedback quality. Cavus (2015) and Cheng (2012) have observed that the web has contributed to the growth of LMS in education, with capabilities in content management and learner administration providing affordable alternatives for instruction delivery, and Poulouva et al. (2015) have affirmed that LMS access to instructional materials and online testing at convenient times and locations directly supports student learning flexibility.

In the dimension of instructional feedback, the overall mean was 4.24 with a standard deviation of 0.62, interpreted as strongly agree and very applicable. The indicator for provision of rubrics and a pointing system for reflections received the highest mean of 4.34 with a standard deviation of 0.60, indicating student recognition that structured rubrics clarify assessment criteria, outline performance levels across categories, and guide the production of

thoughtful reflections. The indicators for giving compliments and adding supplemental modules, for incorporating intervention for failing scores, and for giving chances to failing scores received means of 4.28 with a standard deviation of 0.62, 4.21 with a standard deviation of 0.61, and 4.22 with a standard deviation of 0.60 respectively. The indicator for timely feedback received the lowest mean of 4.17 with a standard deviation of 0.67, falling within the agree category, and this comparatively lower rating is practically significant in that it suggests students perceive a gap in the promptness of feedback delivery. Gašević et al. (2016) have demonstrated that instructional settings must be considered when creating learning analytics-based support interventions, and systems such as OnTask (Pardo et al., 2018) and the Student Relationship Engagement System (Liu et al., 2017) have been designed to enable more individualized process feedback. The lower rating for timely feedback implies that similar feedback-enhancement mechanisms could meaningfully improve the student experience in the evaluated e-learning environments.

In the dimension of instructional assessment, the overall mean was 4.37 with a standard deviation of 0.58, interpreted as strongly agree and very applicable. The indicators for allowing students to answer exercises and for allowing students to answer mind-games activities both received the highest mean of 4.39 with a standard deviation of 0.56, indicating student recognition that exercise-based and game-based assessments foster dynamic learning environments that support knowledge retention, critical thinking, and sustained motivation. The indicator for allowing students to make and answer polls yielded a mean of 4.41 with a standard deviation of 0.54, while the indicator for reflecting on the day's lesson received a mean of 4.37 with a standard deviation of 0.58. The indicator for allowing students to post questions received the lowest mean of 4.28 with a standard deviation of 0.68, within the strongly agree category but with the largest standard deviation in this dimension. Bailey (2015) has established that engaging students through meaningful assignments is a primary institutional duty, and Adzima (2020) has identified the value of obtaining assessment data from a variety of sources to create a rich and meaningful understanding of student learning. The student ratings affirm that the diverse assessment features of the evaluated materials effectively serve these purposes.

In the dimension of learner guidance and support, the overall mean was 4.43 with a standard deviation of 0.56, interpreted as strongly agree and very applicable, representing one of the stronger overall means among student pedagogical usability dimensions. The indicator for provision of relevant information prior to enrollment received the highest mean of 4.49 with a standard deviation of 0.52, reflecting student recognition that clear pre-enrollment information supports informed decision-making and helps students understand course expectations in relation to their academic goals. The indicators for continuing support, advice, and counseling throughout the learning process; for accepting late submission of output; and for accepting late responses in quizzes and polls received means of 4.45 with a standard deviation of 0.57, 4.43 with a standard deviation of 0.55, and 4.43 with a standard deviation of 0.58 respectively. The indicator for counseling and advice in relation to the subject received the lowest mean of 4.34 with a standard deviation of 0.59, within the strongly agree category. Mislinawati and Nurmasyitah (2018) have demonstrated that web-based modules enhance students' comprehension, independence, self-control, motivation, and interactions, while Mamattah (2016) has noted that while most students view e-learning positively as a concept to be promoted, concerns about institutional discrimination against e-learning users remain a contextual consideration.

Learning motivation of Physical Education students

The learning motivation of students was assessed across four dimensions: attention, relevance, confidence, and satisfaction. All four dimensions yielded overall means within the strongly agree and very applicable range, reflecting high motivational engagement among the 300 student respondents.

In the dimension of attention, the overall mean was 4.44 with a standard deviation of 0.53, interpreted as strongly agree and very applicable. The indicator for performing activities of one's own will received the highest mean of 4.52 with a standard deviation of 0.52, indicating that the e-learning materials empower students to manage their learning process actively rather than as passive followers of instruction. The indicators for reflecting on the activities and for participating in video discussions both yielded a mean of 4.49 with a standard deviation of 0.52, while the indicator for enjoying answering the assessments received a mean of 4.39 with a standard deviation of 0.53. The indicator for further exploring the topic received the lowest mean of 4.30 with a standard deviation of 0.58, remaining within the strongly agree category. Lowes and Lin (2015) have established that students in online learning settings frequently seek to improve their self-regulation abilities and that teachers must assist students in identifying their locus of control and how it influences their learning behaviors. The strong student attention ratings affirm the presence of self-regulating and intrinsically motivated learning dispositions in the evaluated context.

In the dimension of relevance, the overall mean was 4.54 with a standard deviation of 0.56, interpreted as strongly agree and very applicable. The indicator affirming that the material is important as the way in which students submit output received the highest mean of 4.60 with a standard deviation of 0.51, reflecting student recognition of the material as an indispensable platform for fulfilling academic requirements. The indicators for finding the material important as a way of getting subject information, as the bank of the subject, and as engaging with content and the learning process received means of 4.57 with a standard deviation of 0.54, 4.55 with a standard deviation of 0.54, and 4.54 with a standard deviation of 0.54 respectively. The indicator for finding the material essential in the learning process received the lowest mean of 4.45 with a standard deviation of 0.65, within the strongly agree category. Alamri et al. (2020), Lee et al. (2015), and Bedenlier et al. (2020) have collectively affirmed that providing students with access to varied learning resources, individualized learning opportunities, and navigation support empowers learners to make autonomous decisions and strengthens perceived relevance, a principle clearly evidenced in the student relevance ratings.

In the dimension of confidence, the overall mean was 4.46 with a standard deviation of 0.59, interpreted as strongly agree and very applicable. The indicators for acquiring more knowledge about the subject and for feelings being valued through reflection both received the highest mean of 4.50, with standard deviations of 0.52 and 0.55 respectively, reflecting student recognition that the LMS provides a space where emotional and intellectual engagement are both recognized and valued. The indicators for opinions being appreciated through interactive discussion and for attitudes being appreciated through open letter suggestions received means of 4.48 with a standard deviation of 0.60 and 4.45 with a standard deviation of 0.59 respectively. The indicator for engagement with the subject having increased received the lowest mean of 4.37 with a standard deviation of 0.66, within the strongly agree category but with the largest standard deviation in this dimension, indicating greater variability in student assessments of engagement growth. Zhao et al. (2021) have established that adolescent self-esteem positively predicts academic involvement, and Fitri et al. (2018) have identified that students lacking confidence tend to withdraw and avoid participation. The strong confidence ratings affirm that the e-learning environment evaluated in this study actively fosters student self-assurance.

In the dimension of satisfaction, the overall mean was 4.55 with a standard deviation of 0.56, interpreted as strongly agree and very applicable, the highest overall mean among the four student motivational dimensions. The indicator for ideas becoming relevant through interactive discussions received the highest mean of 4.60 with a standard deviation of 0.54, indicating student recognition that interactive discussions empower meaningful participation and collaborative learning. The indicators for feelings getting fulfilled through compliments and feedback and for opinions becoming relevant through compliments and feedback received means of 4.59 with a standard deviation of 0.54 and 4.58 with a standard deviation of 0.55 respectively. The indicator for knowledge having increased with the help of the material yielded a mean of 4.55 with a standard deviation of 0.55, while the indicator for needs on the subject matter being fulfilled received the lowest mean of 4.45 with a standard deviation of 0.61, within the strongly agree category. Almaiah et al. have identified service quality and content quality as the factors with the biggest impact on students' satisfaction with mobile learning systems, and the student satisfaction ratings affirm that both dimensions are effectively addressed in the evaluated e-learning materials.

Effects of web usability and pedagogical usability on students' motivational levels

A multivariate general linear model (GLM) was conducted to investigate the effects of web usability and pedagogical usability factors on students' motivational levels, based on student perceptions from the 300 respondents. The multivariate test results identified four statistically significant predictors. Learnability as a web usability factor yielded Wilks' Lambda = 0.937, $F(4, 284) = 4.81$, $p < .001$, partial $\eta^2 = .063$, leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis. Visual design as a web usability factor yielded Wilks' Lambda = 0.961, $F(4, 284) = 2.92$, $p = .022$, partial $\eta^2 = .039$, also leading to the rejection of the null hypothesis. Instructional assessment as a pedagogical usability factor yielded Wilks' Lambda = 0.924, $F(4, 284) = 5.85$, $p < .001$, partial $\eta^2 = .076$, leading to the rejection of the null hypothesis. Learner guidance and support as a pedagogical usability factor yielded Wilks' Lambda = 0.935, $F(4, 284) = 4.95$, $p = .001$, partial $\eta^2 = .065$, also leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis. These results demonstrate that learnability, visual design, instructional assessment, and learner guidance and support exert statistically significant effects on overall student motivation in online physical education delivery.

The remaining predictors produced no statistically significant multivariate effects. Navigation yielded Wilks' Lambda = 0.970, $F(4, 284) = 2.17$, $p = .073$, partial $\eta^2 = .030$; accessibility yielded Wilks' Lambda = 0.970, $F(4, 284) = 2.17$, $p = .072$, partial $\eta^2 = .030$; consistency yielded Wilks' Lambda = 0.995, $F(4, 284) = 2.91$, $p = .846$, partial $\eta^2 = .005$; interactivity yielded Wilks' Lambda = 0.986, $F(4, 284) = 1.00$, $p = .403$, partial $\eta^2 = .014$; content and resources yielded Wilks' Lambda = 0.995, $F(4, 284) = 0.38$, $p = .823$, partial $\eta^2 = .005$; multimedia use yielded Wilks' Lambda = 0.979, $F(4, 284) = 1.51$, $p = .198$, partial $\eta^2 = .021$; learning strategies design yielded Wilks' Lambda = 0.976, $F(4, 284) = 1.76$, $p = .135$, partial $\eta^2 = .024$; and instructional feedback yielded Wilks' Lambda = 0.991, $F(4, 284) = 0.65$, $p = .622$, partial $\eta^2 = .009$. All p-values exceeded the 0.05 threshold, leading to the acceptance of the null hypothesis for each of these predictors. Zhu (2017) and Kurucay and Inan (2017) have affirmed that perceived learning outcomes are the most important indicator of educational success and that they can be measured through achievement, academic performance, or perceived learning achievement. The significant effects identified for four usability factors affirm that platform design and pedagogical support are meaningful contributors to motivationally relevant student learning outcomes.

The tests of between-subjects effects examined which specific motivational components were influenced by each usability factor. The corrected models for all four dependent variables were statistically significant, with attention yielding $F(12, 287) = 8.909$, $p < .001$, $\eta^2 = .271$; relevance yielding $F(12, 287) = 9.385$, $p < .001$, $\eta^2 = .282$; confidence yielding $F(12, 287) = 8.229$, $p < .001$, $\eta^2 = .256$; and satisfaction yielding $F(12, 287) = 6.279$, $p < .001$, $\eta^2 = .208$. Instructional assessment as a pedagogical usability factor had a significant positive effect on attention, $F(1, 287) = 22.588$, $p < .001$, $\eta^2 = .073$. Learner guidance and support as a pedagogical usability factor significantly influenced relevance, $F(1, 287) = 19.166$, $p < .001$, $\eta^2 = .064$. Navigation as a web usability factor significantly affected both confidence, $F(1, 287) = 4.015$, $p = .046$, $\eta^2 = .014$, and satisfaction, $F(1, 287) = 5.808$, $p = .017$, $\eta^2 = .020$. Learnability as a web usability factor significantly influenced relevance, $F(1, 287) = 7.237$, $p = .008$, $\eta^2 = .025$. Accessibility as a web usability factor had a significant effect on relevance, $F(1, 287) = 5.407$, $p = .021$, $\eta^2 = .018$. Visual design as a web usability factor significantly influenced relevance, $F(1, 287) = 7.612$, $p = .006$, $\eta^2 = .026$. The remaining predictors, including interactivity, content and resources, multimedia use, learning strategies design, instructional feedback, and consistency, did not significantly affect any of the motivation components in the separate analyses, with all p-values exceeding .05.

A multiple linear regression analysis was conducted to quantify the predictive contributions of the significant usability factors to specific motivational outcomes. Instructional assessment as a pedagogical usability factor significantly predicted attention, with $B = 0.220$, $SE = 0.046$, $t = 4.753$, $p < .001$, partial $\eta^2 = .073$. Learner guidance and support as a pedagogical usability factor significantly predicted relevance, with $B = 0.253$, $SE = 0.057$, $t = 4.429$, $p < .001$, partial $\eta^2 = .064$. Learnability as a web usability factor also significantly predicted relevance, with $B = 0.160$, $SE = 0.059$, $t = 2.690$, $p = .008$, partial $\eta^2 = .025$. Accessibility as a web usability factor significantly predicted relevance, with $B = 0.139$, $SE = 0.060$, $t = 2.325$, $p = .021$, partial $\eta^2 = .018$. Visual design as a web usability factor significantly predicted relevance, with $B = 0.161$, $SE = 0.059$, $t = 2.759$, $p = .006$, partial $\eta^2 = .026$. Navigation as a web usability factor significantly predicted confidence, with $B = 0.128$, $SE = 0.064$, $t = 2.004$, $p = .046$, partial $\eta^2 = .014$. Learnability as a web usability factor also significantly predicted confidence, with $B = 0.183$, $SE = 0.066$, $t = 2.778$, $p = .006$, partial $\eta^2 = .026$. Navigation as a web usability factor negatively predicted satisfaction, with $B = -0.144$, $SE = 0.060$, $t = -2.410$, $p = .017$, partial $\eta^2 = .012$. Cyr et al. (2006, 2018), Demangeot and Broderick (2010), and Karimov et al. (2011) have collectively established that visual design, social cues, information content, and navigation are significant components of website design that shape consumer perceptions and responses, and the regression results affirm these relationships specifically within the context of students' motivational engagement with online physical education materials.

The findings of this study collectively establish that the web usability and pedagogical usability of e-learning materials in select state universities in Region IV-A are perceived at high levels by both Physical Education faculty and students, with all overall dimension means falling within the strongly agree and very applicable range. Faculty respondents consistently reported higher mean scores across web and pedagogical usability dimensions compared to students, with particularly pronounced differences in interactivity and consistency, suggesting that faculty and students bring different standards and experiential lenses to their evaluations of e-learning functionality. Faculty motivation was uniformly high, with perfect mean scores of 5 recorded for knowledge acquisition and two satisfaction indicators, while student motivation, though strong across all four ARCS dimensions, showed somewhat greater variance, particularly in confidence and attention. The multivariate and regression analyses

revealed that, among faculty perceptions, instructional assessment was the sole statistically significant predictor of motivational outcomes, yielding a large effect size of partial $\eta^2 = .489$, while the regression further identified learnability, visual design, and instructional assessment as the key predictors of specific motivational components. Among student perceptions, four predictors, namely learnability, visual design, instructional assessment, and learner guidance and support, significantly affected overall motivation, with the between-subjects and regression analyses further specifying that instructional assessment most strongly predicts attention, learner guidance and support most strongly predicts relevance, and navigation significantly predicts both confidence and satisfaction. These findings contribute to the growing body of research on e-learning usability and motivation by demonstrating that pedagogical design features, particularly instructional assessment and learner guidance, are at least as consequential as web design attributes in determining motivational outcomes in online physical education. The results carry actionable implications for curriculum designers, institutional administrators, and faculty in Region IV-A and beyond, pointing toward the prioritization of clear, well-scaffolded assessment mechanisms and comprehensive learner support systems as critical investments for enhancing online learning motivation. The subsequent chapter presents the conclusions and recommendations of the study, drawing directly from these findings to propose evidence-based directions for policy, instructional practice, and future research in e-learning-based physical education.

CONCLUSION

This study examined the web usability, pedagogical usability, and learning motivation of Physical Education faculty and students from select state universities in Region IV-A, with the aim of determining how usability dimensions influence motivational outcomes in online learning environments. The findings yielded several significant conclusions.

Both faculty and students perceived the web usability and pedagogical usability of e-learning materials at consistently high levels, with all overall dimension means falling within the strongly agree and very applicable range. Faculty assessments were uniformly higher across all web and pedagogical usability dimensions, particularly in interactivity and consistency, suggesting that faculty and students apply different evaluative standards shaped by their respective roles and experiences with the platform. The sole exception among student pedagogical usability ratings was interactivity, which fell within the agree category, reflecting students' more direct awareness of the practical limitations of interactive features in actual use.

Faculty and student motivation were both strong across all four ARCS dimensions, attention, relevance, confidence, and satisfaction, with faculty reporting perfect mean scores for knowledge acquisition and two satisfaction indicators, and students demonstrating high but more variable motivation, particularly in confidence and attention. These results confirm that e-learning environments in the evaluated context are effective in sustaining high motivational engagement among both instructors and learners.

From the perspective of faculty, instructional assessment emerged as the sole statistically significant predictor of student motivation, yielding a large effect size, with the regression analysis further identifying learnability and visual design as meaningful predictors of specific motivational components. These findings indicate that, as perceived by faculty, the clarity of the platform's learning interface and the quality of its assessment design are the most consequential usability features for student motivation.

From the perspective of students, four usability factors, learnability, visual design, instructional assessment, and learner guidance and support, exerted statistically significant effects on overall motivation. More specifically, instructional assessment most strongly predicted attention; learner guidance and support most strongly predicted relevance;

learnability and accessibility significantly predicted relevance; learnability also predicted confidence; and navigation predicted both confidence and satisfaction, with a negative effect on the latter. These findings collectively affirm that pedagogical design features are at least as influential as web design attributes in shaping motivational outcomes, and that no single dimension operates in isolation.

Taken together, the results of this study demonstrate that purposeful investment in well-scaffolded assessment mechanisms, clear and progressive instructional design, robust learner support systems, and coherent visual and navigational design is essential for maximizing student motivation in online physical education. These conclusions provide actionable direction for curriculum developers, instructional designers, and institutional administrators in Region IV-A and comparable contexts, underscoring the need for evidence-based, holistic approaches to e-learning platform development that treat usability and pedagogical quality as mutually reinforcing imperatives rather than separate concerns.

REFERENCES

- Aboagye, E., Yawson, J. A., & Appiah, K. N. (2020). COVID-19 and e-learning: The challenges of students in tertiary institutions. *Social Education Research*, 1–8. <https://doi.org/10.37256/ser.212021422>
- Acosta-Vargas, P., Acosta, T., & Lujan-Mora, S. (2018). Challenges to assess accessibility in higher education websites: A comparative study of Latin America universities. *IEEE Access*, 6, 36500–36508. <https://doi.org/10.1109/access.2018.2848978>
- Ahmad, R., & Mahmood, A. (2025). Effect of ARCS (attention, relevance, confidence, and satisfaction) model on academic achievement of 9th-grade biology students. *Qlantic Journal of Social Sciences*, 6(2), 165–176.
- Aini, Q., Budiarto, M., Putra, P. O. H., & Rahardja, U. (2020). Exploring e-learning challenges during the global COVID-19 pandemic: A review. *Jurnal Sistem Informasi*, 16(2), 57–65.
- Al-Amin, M., Zubayer, A. A., Deb, B., & Hasan, M. (2021). Status of tertiary level online class in Bangladesh: Students' response on preparedness, participation and classroom activities. *Heliyon*, 7(1), e05943. <https://doi.org/10.1016/j.heliyon.2021.e05943>
- Ali, W. (2020). Online and remote learning in higher education institutes: A necessity in light of COVID-19 pandemic. *Higher Education Studies*, 10(3), 16. <https://doi.org/10.5539/hes.v10n3p16>
- Ali, Q., Abbas, A., Raza, A., Khan, M. T. I., Zulfiqar, H., Iqbal, M. A., Nayak, R. K., & Alotaibi, B. A. (2023). Exploring the students' perceived effectiveness of online education during the COVID-19 pandemic: Empirical analysis using structural equation modeling (SEM). *Behavioral Sciences*, 13(7), 578. <https://doi.org/10.3390/bs13070578>
- Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2019). Evaluating e-learning systems success: An empirical study. *Computers in Human Behavior*, 102, 67–86. <https://doi.org/10.1016/j.chb.2019.08.004>

- Allo, M. D. G. (2020). Is the online learning good in the midst of Covid-19 pandemic? The case of EFL learners. *Jurnal Sinestesia*, 10(1), 1–10. <https://sinestesia.pustaka.my.id/journal/article/download/24/1>
- Althunibat, A., Almaiah, M., & Altarawneh, F. (2021). Examining the factors influencing the mobile learning applications usage in higher education during the COVID-19 pandemic. *Electronics*, 10(21), 2676. <https://doi.org/10.3390/electronics10212676>
- Alshammari, M. (2016). Adaptation based on learning style and knowledge level in e-learning systems. <https://etheses.bham.ac.uk/id/eprint/6702>
- Aparicio, M., Bacao, F., & Oliveira, T. (2016). An e-learning theoretical framework. *Educational Technology & Society*, 19(1), 292–307. http://www.ifets.info/journals/19_1/24.pdf
- Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., & Umek, L. (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability*, 12(20), 8438. <https://doi.org/10.3390/su12208438>
- Ayan, E., Toy, F., Türktan, O., & Gökce, M. (2023). Bibliometric analysis of academic studies on student support systems in open and distance learning. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, 23(4), 1489–1516. <https://doi.org/10.18037/ausbd.1312165>
- Bali, M., & Caines, A. (2018). A call for promoting ownership, equity, and agency in faculty development via connected learning. *International Journal of Educational Technology in Higher Education*, 15(1). <https://doi.org/10.1186/s41239-018-0128-8>
- Binyamin, S. S. (2019). Using the technology acceptance model to measure the effects of usability attributes and demographic characteristics on student use of learning management systems in Saudi higher education.
- Blundell, G. E., Castañeda, D. A., & Lee, J. (2020). A multi-institutional study of factors influencing faculty satisfaction with online teaching and learning. *Online Learning*, 24(4). <https://doi.org/10.24059/olj.v24i4.2175>
- Bozkurt, A., & Sharma, R. C. (2020). Education in normal, new normal, and next normal: Observations from the past, insights from the present and projections for the future. Zenodo (CERN European Organization for Nuclear Research). <https://doi.org/10.5281/zenodo.4362664>
- Brammer, S. E., & Punyanunt-Carter, N. M. (2022). Getting the attention of online learners. *Communication Education*, 71(2), 155–157. <https://doi.org/10.1080/03634523.2021.2022732>
- Bueno, M., Perez, F., Valerio, R., & Areola, E. M. Q. (2022). A usability study on Google Site and Wordwall.Net: Online instructional tools for learning basic integration amid pandemic. *Journal of Global Business and Social Entrepreneurship (GBSE)*, 7(23), 61–71.
- Çeken, B., & Taşkın, N. (2022). Multimedia learning principles in different learning environments: A systematic review. *Smart Learning Environments*, 9(1), 19. <https://doi.org/10.1186/s40561-022-00200->

Centeio, E., Mercier, K., Garn, A., Erwin, H., Marttinen, R., & Foley, J. (2021). The success and struggles of physical education teachers while teaching online during the COVID-19 pandemic. *Journal of Teaching in Physical Education*, 40(4), 667–673. <https://doi.org/10.1123/jtpe.2020-0295>

Chavez, J., & Lamorinas, D. D. (2023). Reconfiguring assessment practices and strategies in online education during the pandemic. *International Journal of Assessment Tools in Education*, 10(1), 160–174. <https://doi.org/10.21449/ijate.1094589>

Chiu, T. K. F. (2021). Applying the self-determination theory (SDT) to explain student engagement in online learning during the COVID-19 pandemic. *Journal of Research on Technology in Education*, 54(sup1). <https://doi.org/10.1080/15391523.2021.1891998>

Coman, C., Țîru, L. G., Meseșan-Schmitz, L., Stanciu, C., & Bularca, M. C. (2020). Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective. *Sustainability*, 12(24), 10367. <https://doi.org/10.3390/su122410367>

Cruickshank, V. J., Pill, S., & Mainsbridge, C. (2021). 'Just do some physical activity': Exploring experiences of teaching physical education online during Covid-19. *Issues in Educational Research*, 31(1), 76–93. <http://www.iier.org.au/iier31/cruickshank.pdf>

D'Agostino, E. M., Urtel, M., Webster, C. A., McMullen, J., & Culp, B. (2021). Virtual physical education during COVID-19: Exploring future directions for equitable online learning tools. *Frontiers in Sports and Active Living*, 3. <https://doi.org/10.3389/fspor.2021.716566>

Daniel, J. (2020). Education and the COVID-19 pandemic. *Prospects*, 49(1–2), 91–96. <https://doi.org/10.1007/s11125-020-09464-3>

Devine, A., & Chávez, J. L. (2025). Exploring strategies to improve student engagement in online courses in higher education. <https://doi.org/10.17918/00011018>

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems*, 49(1), 5–22. <https://doi.org/10.1177/0047239520934018>

Erlangga, D. T. (2022). Student problems in online learning: Solutions to keep education going on. *Journal of English Language Teaching and Learning*, 3(1), 21–26. <https://doi.org/10.33365/jeltl.v3i1.1694>

Evans, P., Vansteenkiste, M., Parker, P., Kingsford-Smith, A., & Zhou, S. (2024). Cognitive load theory and its relationships with motivation: A self-determination theory perspective. *Educational Psychology Review*, 36(1). <https://doi.org/10.1007/s10648-023-09841-2>

Fang, X., Ng, D. T. K., Leung, J. K. L., & Xu, H. (2023). The applications of the ARCS model in instructional design, theoretical framework, and measurement tool: A systematic review of empirical studies. *Interactive Learning Environments*, 32(10), 5919–5946. <https://doi.org/10.1080/10494820.2023.2240867>

- Imtihan, K. (2024). The impact of visual quality and user interface responsiveness on student satisfaction in academic information systems (AIS). *Pakistan Journal of Life and Social Sciences (PJLSS)*, 22(2). <https://doi.org/10.57239/pjlss-2024-22.2.001455>
- Irfan, M., Kusumaningrum, B., Yulia, Y., & Widodo, S. A. (2020). Challenges during the pandemic: Use of e-learning in mathematics learning in higher education. *Infinity Journal*, 9(2), 147. <https://doi.org/10.22460/infinity.v9i2.p147-158>
- Ismail, S. M., Rahul, D. R., Patra, I., & Rezvani, E. (2022). Formative vs. summative assessment: Impacts on academic motivation, attitude toward learning, test anxiety, and self-regulation skill. *Language Testing in Asia*, 12(1). <https://doi.org/10.1186/s40468-022-00191-4>
- Joaquin, J. J. B., Biana, H. T., & Dacela, M. A. (2020). The Philippine higher education sector in the time of COVID-19. *Frontiers in Education*, 5. <https://doi.org/10.3389/feduc.2020.576371>
- Jongmans, E., Jeannot, F., Liang, L., & Dampérat, M. (2022). Impact of website visual design on user experience and website evaluation: The sequential mediating roles of usability and pleasure. *Journal of Marketing Management*, 38(17–18), 2078–2113. <https://doi.org/10.1080/0267257x.2022.2085315>
- Kazanidis, I., Pellas, N., Fotaris, P., & Tsinakos, A. (2018). Can the flipped classroom model improve students' academic performance and training satisfaction in higher education instructional media design courses? *British Journal of Educational Technology*, 50(4), 2014–2027. <https://doi.org/10.1111/bjet.12694>
- Kent, C., Laslo, E., & Rafaeli, S. (2016). Interactivity in online discussions and learning outcomes. *Computers & Education*, 97, 116–128. <https://doi.org/10.1016/j.compedu.2016.03.002>
- Kim, J. (2020). Learning and teaching online during COVID-19: Experiences of student teachers in an early childhood education practicum. *International Journal of Early Childhood*, 52(2), 145–158. <https://doi.org/10.1007/s13158-020-00272-6>
- Kummitha, H. R., Kolloju, N., Chittoor, P., & Madepalli, V. (2021). Coronavirus disease 2019 and its effect on teaching and learning process in the higher educational institutions. *Higher Education for the Future*, 8(1), 90–107. <https://doi.org/10.1177/2347631120983650>
- Li, Q., & Luximon, Y. (2019). Older adults' use of mobile device: Usability challenges while navigating various interfaces. *Behaviour and Information Technology*, 39(8), 837–861. <https://doi.org/10.1080/0144929x.2019.1622786>
- Li, X., & Wang, Y. (2018). Impact of website navigation design on user experience: An empirical study. *International Journal of Human–Computer Interaction*, 34(9), 849–862. <https://doi.org/10.1080/10447318.2018.1431224>
- Lim, L., Gentili, S., Pardo, A., Kovanović, V., Whitelock-Wainwright, A., Gašević, D., & Dawson, S. (2019). What changes, and for whom? A study of the impact of learning analytics-

based process feedback in a large course. *Learning and Instruction*, 72, 101202. <https://doi.org/10.1016/j.learninstruc.2019.04.003>

Lomellini, A., Lowenthal, P. R., Snelson, C., & Trespalacios, J. H. (2025). Accessible and inclusive online learning in higher education: A review of the literature. *Journal of Computing in Higher Education*, 37(3), 1306–1329. <https://doi.org/10.1007/s12528-024-09424-2>

Lu, K., Pang, F., & Shadiev, R. (2023). Understanding college students' continuous usage intention of asynchronous online courses through extended technology acceptance model. *Education and Information Technologies*, 28(8), 9747–9765. <https://doi.org/10.1007/s10639-023-11591-1>

Maatuk, A. M., Elberkawi, E. K., Aljawarneh, S., Rashaideh, H., & Alharbi, H. (2021). The COVID-19 pandemic and e-learning: Challenges and opportunities from the perspective of students and instructors. *Journal of Computing in Higher Education*, 34(1), 21–38. <https://doi.org/10.1007/s12528-021-09274-2>

Makda, F. (2024). Digital education: Mapping the landscape of virtual teaching in higher education – a bibliometric review. *Education and Information Technologies*, 30(2), 2547–2575. <https://doi.org/10.1007/s10639-024-12899-2>

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, 22(1). <https://doi.org/10.24059/olj.v22i1.1092>

Mercier, K., Centeio, E., Garn, A., Erwin, H., Marttinen, R., & Foley, J. (2021). Physical education teachers' experiences with remote instruction during the initial phase of the COVID-19 pandemic. *Journal of Teaching in Physical Education*, 40(2), 337–342. <https://doi.org/10.1123/jtpe.2020-0272>

Miller, C. N. (2024). A study of learnability in software as perceived by practitioners in user experience and learning design professions [Doctoral dissertation, Old Dominion University]. <https://doi.org/10.25777/244N-R853>

Mohd Noor, N. H. (2023). Satisfaction with online distance learning: Evaluating the attention, relevance, confidence, and satisfaction (ARCS) model.

Mollenkopf, D., Gaskill, M., Nelson, R. M., & Diaz, C. C. (2020). Navigating a "new normal" during the COVID-19 pandemic: College student perspectives of the shift to remote learning. *Revue Internationale Des Technologies En Pédagogie Universitaire*, 17(2), 67–79. <https://doi.org/10.18162/ritpu-2020-v17n2-08>

Mosa, A. A., Mohd. Naz'ri bin Mahrin, & Ibrahim, R. (2016). Technological aspects of e-learning readiness in higher education: A review of the literature. *Computer and Information Science*, 9(1), 113–127. <http://dx.doi.org/10.5539/cis.v9n1p113>

- Namli, A. K., & Yücekaya, M. A. (2021). Motivation and job satisfaction of physical education teachers during pandemic. *Opus Uluslararası Toplum Araştırmaları Dergisi*, 17(Pandemi Özel Sayısı), 3148–3172. <https://doi.org/10.26466/opus.887856>
- Nielsen Norman Group. (2020, October 29). How to measure learnability. <https://www.nngroup.com/articles/measure-learnability/>
- O'Brien, W., Adamakis, M., Brien, N. O., Onofre, M., Martins, J., Dania, A., Makopoulou, K., Herold, F., Ng, K., & Costa, J. (2020). Implications for European physical education teacher education during the COVID-19 pandemic: A cross-institutional SWOT analysis. *European Journal of Teacher Education*, 43(4), 503–522. <https://doi.org/10.1080/02619768.2020.1823963>
- Panadero, E., & Lipnevich, A. A. (2021). A review of feedback models and typologies: Towards an integrative model of feedback elements. *Educational Research Review*, 35, 100416. <https://doi.org/10.1016/j.edurev.2021.100416>
- Parlakkiliç, A. (2021). Evaluating the effects of responsive design on the usability of academic websites in the pandemic. *Education and Information Technologies*, 27(1), 1307–1322. <https://doi.org/10.1007/s10639-021-10650-9>
- Prestoza, M. J. (2024). Assessing remote learning's feasibility: A comprehensive analysis of Philippine public-school teachers' use of learning management systems and blended learning approaches. *Journal of Research Policy & Practice of Teachers & Teacher Education*, 14(1), 21–27. <https://doi.org/10.37134/jrpptte.vol14.1.3.2024>
- Qazi, A., Qazi, J., Naseer, K., Zeeshan, M., Qazi, S., Abayomi-Alli, O., Ahmad, I. S., Darwich, M., Talpur, B. A., Hardaker, G., Naseem, U., Yang, S., & Haruna, K. (2021). Adaption of distance learning to continue the academic year amid COVID-19 lockdown. *Children and Youth Services Review*, 126, 106038. <https://doi.org/10.1016/j.childyouth.2021.106038>
- Rahman, T., Prasetyo, D. A., & Mashuri, H. (2021). The impact of online learning during the COVID-19 pandemic on physical education teachers. *Halaman Olahraga Nusantara (Jurnal Ilmu Keolahragaan)*, 4(2), 294. <https://doi.org/10.31851/hon.v4i2.5638>
- Rajabalee, B. Y., Santally, M. I., & Rennie, F. (2019). A study of the relationship between students' engagement and their academic performances in an eLearning environment. *E-Learning and Digital Media*, 17(1), 1–20. <https://doi.org/10.1177/2042753019882567>
- Rauf, W., Rajab, A., & Nashruddin, N. (2023). Exploring the learning design on learning management system for online learning: A case study in higher education. *Jurnal Ilmiah Profesi Pendidikan*, 8(1), 1–10. <https://doi.org/10.29303/jipp.v8i1.1075>
- Saidah, S. (2024). The impact of students' academic self-confidence on the English learning process in the post-pandemic era. *Journal of Languages and Language Teaching*, 12(1), 341. <https://doi.org/10.33394/joltt.v12i1.8979>
- Şenel, S., & Şenel, H. C. (2021). Remote assessment in higher education during COVID-19 pandemic. *International Journal of Assessment Tools in Education*, 8(2), 181–199. <https://doi.org/10.21449/ijate.820140>

Shalgimbekova, K., Smagliy, T., Kalimzhanova, R., & Suleimenova, Z. (2024). Innovative teaching technologies in higher education: Efficiency and student motivation. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186x.2024.2425205>

Simamora, R. M. (2020). The challenges of online learning during the COVID-19 pandemic: An essay analysis of performing arts education students. *Studies in Learning and Teaching*, 1(2), 86–103. <https://doi.org/10.46627/silet.v1i2.38>

Skulmowski, A., & Xu, K. M. (2021). Understanding cognitive load in digital and online learning: A new perspective on extraneous cognitive load. *Educational Psychology Review*, 34(1), 171–196. <https://doi.org/10.1007/s10648-021-09624-7>

Tang, C., Gill, A., Pike, M., & Towey, D. (2021). Creating a virtual reality OER application to teach web accessibility. 2022 IEEE 46th Annual Computers, Software, and Applications Conference (COMPSAC), 1137–1142. <https://doi.org/10.1109/compsac51774.2021.00156>

Thelma, C. C., Sain, Z. H., Mpolomoka, D. L., Akpan, W. M., & Davy, M. (2024). Curriculum design for the digital age: Strategies for effective technology integration in higher education. Zenodo (CERN European Organization for Nuclear Research). <https://doi.org/10.5281/zenodo.13123899>

Todd, R. W. (2020). Teachers' perceptions of the shift from the classroom to online teaching. *International Journal of TESOL Studies*. <https://doi.org/10.46451/ijts.2020.09.02>

Turnbull, D., Chugh, R., & Luck, J. (2021). Transitioning to e-learning during the COVID-19 pandemic: How have higher education institutions responded to the challenge? *Education and Information Technologies*, 26(5), 6401–6419. <https://doi.org/10.1007/s10639-021-10633-w>

Vygotsky, L. S., & Luria, A. R. (2017). The role of interest in physical education: A review of research evidence. ResearchGate. <https://doi.org/10.13140/RG.2.2.28743.33445>

Wahyuni, S. (2023). Effective teaching practices in higher education during Covid-19 pandemic: Lecturers and students' lens. *NOBEL Journal of Literature and Language Teaching*, 14(1), 28–44. <https://doi.org/10.15642/nobel.2023.14.1.28-44>

Yu, J., & Jee, Y. (2020). Analysis of online classes in physical education during the COVID-19 pandemic. *Education Sciences*, 11(1), 3. <https://doi.org/10.3390/educsci11010003>

Yunusa, A. A., & Umar, I. N. (2020). A scoping review of critical predictive factors (CPFs) of satisfaction and perceived learning outcomes in e-learning environments. *Education and Information Technologies*, 26(1), 1223–1270. <https://doi.org/10.1007/s10639-020-10286-1>

Zheng, W., Ma, Y., & Lin, H. (2021). Research on blended learning in physical education during the COVID-19 pandemic: A case study of Chinese students. *SAGE Open*, 11(4). <https://doi.org/10.1177/21582440211058196>