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# Walk, run, jump and learn: Interactive multimedia for teaching locomotor skills in primary schools

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**Abstract:** Technology drives the development of interactive and customizable learning media, catering to diverse learner needs. The learning media in locomotor motion educational game applications in PE learning is the result of this research. This research develops interactive learning media using Construct 2 software on locomotor motion material for third graders students. This research applies the Brog and Gall model of research and development (R&D), involving media experts, material experts, physical education (PE) teachers, and students. The practicality test engaged PE teachers from three distinct schools, yielding an impressive average score of 98.89%, indicative of excellent practicality. The development of Construct 2-based learning media has proven very feasible to be used as an interactive learning media to increase student interest and participation in locomotor motion learning, creating an attractive and relevant learning atmosphere with the demands of today's all-digital era.

**Keywords:** interactive multimedia; locomotor skills; primary schools; walk-run-jump

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## 1. Introduction

Amidst the rapid pace of modern advancements, mastering digital literacy emerges as a crucial skill (Akayoğlu et al., 2020; Li & Yu, 2022). The 21st-century era requires us to access information easily through digital media, enabling fast and efficient exchange of information (Alenezi, 2023; van Laar et al., 2020; Xie et al., 2020). Not keeping up with technology can make a person feel left behind, especially in various aspects of life, including education (Dube, 2020; Jesionkowska et al., 2020). Advancements in science and technology have sparked significant transformations, especially in education (Oke & Fernandes, 2020). School students are becoming interconnected with technology, evolving and thriving in the digital era (Bonfield et al., 2020). Therefore, there is a need for innovation and improvement in the education system to improve the quality and quantity of knowledge obtained. Today, education not only molds students' characters but also plays a pivotal role in individual development (Bartelds et al., 2020; Tabroni et al., 2020).

Teachers bear the responsibility of encouraging learners to become independent, creative, and innovative (Hang & Van, 2020; Swanzy-Impraim et al., 2023). In facing the demands of the times, teachers need to understand and master digital literacy (Setiansah et al., 2023; Yeşilyurt & Vezne, 2023). Teachers' digital literacy skills play a role in the success of the learning process. Ahmadi et al (2023) also assert that proficient use of technology by teachers can inspire and motivate students, enhance interest in learning, and ultimately lead to academic success. So, teachers must actively follow technological developments to remain relevant in providing education. Teachers must also acknowledge the importance of digital literacy, as it is reflected in the use of learning media. Technology-based interactive learning media can improve rigidity and monotony in the learning process (Setiansah et al., 2023; Yeşilyurt & Vezne, 2023). Physical Education (PE) plays a vital role

in shaping a healthy and active learner while enhancing academic achievement within the school environment (Sevil-Serrano et al., 2022; Wintle, 2022). In Physical Education (PE), locomotor skill activities are typically introduced at the elementary level in third grader (Syaflin et al., 2021; Yuwono et al., 2022). Komaini et al. (2021) and Palmizal et al. (2020) state that locomotor motion is where it consists of basic movements such as walking, running, and jumping. Physical activity is behavior in daily life. So, an approach to keep students engaged and enthusiastic about participating in fundamental motion education is crucial. Integrating technology in learning PE is a means to improve interest and motivation, especially in understanding the content of locomotor. Educators need to develop educational materials that foster students' enthusiasm for actively engaging in the learning process.

Construct 2 software is one tool that can be utilized in developing technology-based media. Dzikro and Dwiningsih (2021) contend that Construct 2 is user-friendly due to its lack of coding requirements. Sukmawijaya and Fauzi (2020) elaborated that HTML5-based gaming applications offer advantages in Multiplatform Export, enabling them to be exported to various media or devices. Construct 2 is based on Hyper Text Markup Language (HTML) 5, designed to create gamification in learning. Utilizing Construct 2 software in Physical Education (PE) learning is anticipated to enhance the effectiveness of learning activities. It is supported by previous studies that have undergone validity and feasibility tests, with notably high scores, as seen in the research conducted by Samiaji and Kurniawan (2023) on swimming materials, and by Hariyanto (2020) on short-distance running athletic materials. However, according to literature reviews, there has been no development of Physical Education (PE) learning media based on Construct 2 software specifically for locomotor motion materials. Overall, integrating technology into education and creating technology-driven educational tools are essential for achieving efficacy and efficiency in the digital age of learning. Educators must stay abreast of technological advancements to ensure the delivery of relevant education in line with contemporary demands. Consequently, research and development efforts are essential to create interactive learning materials for locomotor motion. It involves assessing the validity, practicality, and response of participants to interactive learning media that focuses on locomotor motion material at the primary school level to increase the motivation and interest of learners in receiving PE learning material.

## 2. Materials and Methods

This study applies the Research and Development (R&D) methodology to convert traditional teaching materials into interactive learning media. The development process adheres to the Borg and Gall model, which typically consists of 10 stages, but due to constraints in materials and time, this study focuses on only five stages.

### *2.1 Research and Data Collection Phase*

During this stage, a literature review was conducted to identify gaps in existing research, followed by field observations to analyze the requirements of Physical Education (PE) teachers.

### *2.2 Planning Phase*

In the second stage, an analysis of core and basic competencies is conducted, aligned with the curriculum implemented in Indonesia (Curriculum 2013). Subsequently, questionnaires are prepared for research subjects, comprising media experts, materials, practicality, and student responses. Additionally, designs are created, and necessary elements for Construct 2 application-based learning media are prepared.

### *2.3 Product Development Phase*

After designing and preparing several necessary elements, the subsequent step involves creating learning media using the Construct 2 application.

### *2.4 Initial Field Trial Phase*

The designed and created products then undergo validation to assess their validity, practicality, and student response to the developed learning media. Several experts served as validators to test the validity of this Learning Media based on media and material aspects during the research conducted from September to November 2023. Grade 3 primary school students participated in this research, initially in a small-scale trial involving a total of 15 students, followed by a large-scale trial with 55 students from several private primary schools in the South Padang sub-district, including SD Kartika I-12, SD Kalam Kudus, and SD Tirtonadi. The data collection technique uses a validation questionnaire involving six experts to test the validity of this Learning Media and respondent questionnaires to PE teachers and students to test the practicality and response of students to this learning media at the stage of small-scale and large-scale trials. The data collected underwent analysis using assessment scales and percentage ranges to assess the validity, practicality, and learner response. This research focuses on developing learning media for PE subjects, with specific material on locomotor motion. The data analysis will provide an overview of the extent of validity, practicality, and student response to learning media for third grader students. As for more details, the frame of mind and division of tasks of each research subject are describe in Figure 1. The assessed aspects of the media developed are described in Table 1.

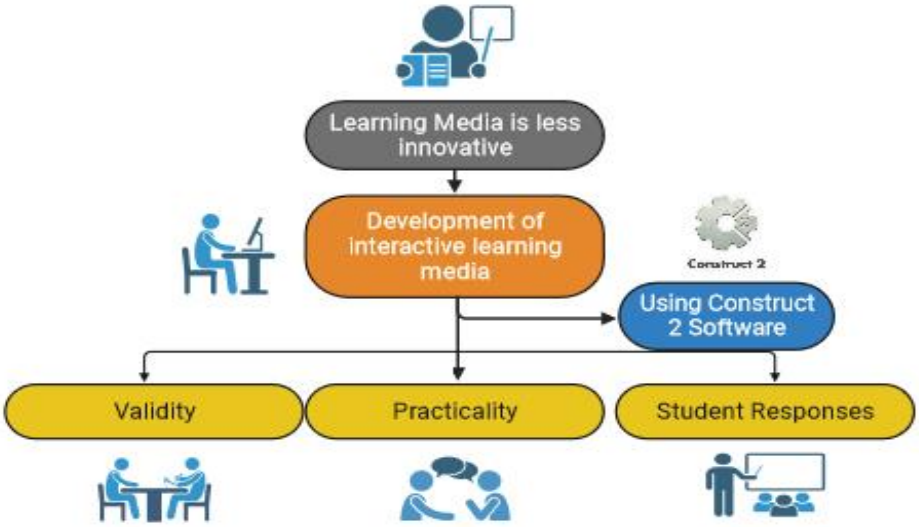


**Figure 1**. Framework for designing interactive learning media research

**Table 1.** The validity aspects.

| No | Subject | Sum | Role | Aspects |
|---|---|---|---|---|
| 1. | Media Validator | 3 | Testing Media Validity from Software, Visual Communication, and Language Aspects | Software, Visual Communication and Language |
| 2. | Material Validator | 3 | Media Feasibility Test from aspects of content quality, presentation, locomotor motion and language | Quality of Content, Presentation, Locomotor Motion and Language |
| 3. | Teachers | 3 | Test the practicality of the media from the point of view of the subject teacher | Quality of Content, Presentation, Locomotor Motion, Language and Technical |
| 4. | Students | 55 | Test the effectiveness of media from the perspective of students | Quality of Content, Presentation, Language and Technical |

Data analysis is conducted to determine the validity, practicality, and student response to the developed learning media. The research data are subjected to descriptive statistical analysis to obtain average values and percentages. The validity analysis

involves assessing validation sheets, utilizing the following steps: assign scores to each item based on responses such as excellent (4), good (3), fair (2), or poor (1), and then sum the total scores obtained from each validator for all indicators. The determination of validity, practicality, and student response values is carried out using a questionnaire:

$$\text{Value Validity} = \frac{\text{Total Score}}{\text{Number of Validators} \times \text{Max Score}} \times 100\%$$

The validity category of learning media development based on final grades can be seen in Table 2. The practicality test and student response use the Likert scale and are analyzed using the validity test criteria (Table 2).

**Table 2.** Validity test criteria

| No. | Interval | Category |
|---|---|---|
| 1 | 81% – 100% | Very Good |
| 2 | 61% – 80% | Good |
| 3 | 41% – 60% | Moderate |
| 4 | 21% – 40% | Not Good |
| 5 | 0% – 20% | Bad |

*2.5 Initial Product Revision Phase*

At the initial product revision stage, an evaluation is conducted on the developed product based on input and feedback from experts and trial results. The evaluation findings are then used to make improvements to the product to achieve the desired level of quality before it is published or widely used. These improvements may include design adjustments, functional enhancements, feature additions, or performance optimizations, depending on the needs and findings from the initial product evaluation.

## 3. Results

*3.1. Research and Data Collection Phase*

This step involves two methods: literature review and observation. During the literature study phase, data collection was conducted by distributing a Google Form to Physical Education (PE) teachers teaching in primary schools in the southern district. The results of a survey conducted among 45 PE teachers in South Padang showed that the use of technology in education is still limited, especially in locomotor motion material. Only 10% of teachers have used applications during the teaching process and require media tools with applications for locomotor materials. Consequently, due to limited innovation in learning media, students frequently grow bored during lessons.

The pandemic that occurred a few years ago also had an impact, necessitating the need for learning materials infused with engaging and exciting technology. Therefore, application-based educational materials on Locomotor Motion material are crucial. It will support teachers and students in achieving their competencies. According to Nisa Suwardi (2021), locomotor motion encompasses activities such as walking, running, and jumping, which are performed in daily life. Interactive learning media is essential to enhance students' understanding of locomotor motion concepts. Such media aims to aid students in developing a deeper comprehension of the locomotor motion concept.

*3.2. Planning Phase*

After aligning with the core and basic competencies of third graders in primary schools (Curriculum 2013), the research instrument prepared is a questionnaire intended for quantitative measurement of research outcomes. This research validation consists of four parts: media validation questions, material validation questions, teacher practice questions, and learner responses. Before being used as a research instrument, the data that has been collected needs to be further verified by an instrument validator. The thorough validation of the tool affirms its reliability, establishing it as an appropriate research

instrument. Following this, the subsequent step entails formulating a design for educational media. In this research, Software Construct 2 is utilized as the software platform for creating learning materials. Following a thorough grasp of the software, the subsequent task is to generate or adapt essential elements to enhance media development, encompassing aspects like backgrounds, animations, games, quizzes, materials, and other components.

### *3.3. Product Development Phase*

This step involves creating or designing an engaging and effective educational game. This learning media is made using Construct 2 software because it can improve learning media equipped with entertaining games and ultimately produce products in the form of applications. Construct 2 is an HTML 5 game that can be downloaded from www.scirra.com website and played on Android or PC. Construct 2 software can be used offline and online. The development of learning media for locomotor motion material is illustrated in Figure 2, Figure 3, Figure 4, and Figure 5.


**Figure 2**. The main menu of learning media


**Figure 3**. The content of learning media


**Figure 4**. The quiz game of learning media

Figure 2 illustrates the primary interface of the educational media, providing access to its features. Figure 3 details the substantive content encapsulated within the media. Transitioning to Figure 4, it delineates the interactive quiz elements embedded within the educational platform. Lastly, Figure 5 elucidates the interactive word game component focused on locomotor motion concepts.


**Figure 5**. The interactive word game of learning media

Furthermore, this product will be validated by media experts and material experts. Media validation is done using questionnaires. Validators in the media section involve three media experts. The assessment consists of three aspects with multiple indicators. The measured aspects are software, visual communication, and language used in the learning media. Table 3 shows the results of validation by media experts.

**Table 3.** The results of validation by media experts

| Aspects | Validator | | | Average | Category |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| Software | 100% | 100% | 100% | 100% | Very Good |
| Visual Communications | 89.29% | 100% | 100% | 96.43% | Very Good |
| Language | 100% | 100% | 87.5% | 95.83% | Very Good |
| **Average** | **96.43%** | **100%** | **95.83%** | **97.42%** | **Very Good** |

According to the media expert validation results, Validator 1 achieved an impressive average score of 96.43%, categorizing it as "very good" validity. Validator 2 attained an outstanding average score of 100%, placing it within the "excellent" validity category. Validator 3 also received a commendable average score of 95.83%, indicating a "very good" validity category. Consequently, the collective average score of the media expert validators stands at 97.42%. Notes and suggestions provided by validators emphasize the importance of incorporating additional captivating animations. Validators in the media section involve three material experts who also understand the material, especially in locomotor motion material. The assessment consists of four aspects evaluated by media experts. The aspects include quality, presentation, locomotor motion concept, and language. Table 4 shows the results of validation by material experts.

**Table 4.** The results of validation by media experts

| Aspects | Validator | | | Average | Category |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| Content Quality | 95% | 100% | 100% | 98.33% | Very Good |
| Serving | 100% | 95.83% | 100% | 98.61% | Very Good |
| Locomotor | 100% | 100% | 100% | 100% | Very Good |
| Language | 100% | 100% | 100% | 100% | Very Good |
| **Average** | **98.75%** | **98.96%** | **100%** | **99.24%** | **Very Good** |

Following the material expert validation phase, Validator 1 achieved a notable average score of 98.75%, indicating "very good" validity. Validator 2 demonstrated excellence, securing an average score of 98.96% and positioning within the "excellent" validity category. Validator 3 also attained a commendable average score of 100%, signifying a "very good" validity category. The average overall media expert validator score is 99.24%. Notes and suggestions from validators are to add more varied motion models, especially in locomotor motion.

### *3.4. Initial Field Trial Phase*

Learning media that were developed and have gone through the validity stages of several media and material experts were then tested for practicality by several PE teachers from three different schools. Practicality assessment is carried out by providing an assessment angle. Table 5 describes the result of the practicality test.

**Table 5.** The results of practicality test by PE teacher

| Aspects | Teachers | | | Average | Category |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| Content Quality | 100% | 100% | 91.66% | 97.22% | Very Good |
| Serving | 100% | 100% | 91.66% | 97.22% | Very Good |
| Locomotor | 100% | 100% | 100% | 100% | Very Good |
| Language | 100% | 100% | 100% | 100% | Very Good |
| Technical Aspects | 100% | 100% | 100% | 100% | Very Good |
| **Average** | **100%** | **100%** | **96.66%** | **98.89%** | **Very Good** |

After conducting the practicality test involving 3 PE teachers, Teacher 1 achieved a perfect score of 100%, indicating "very good" practicality. Additionally, two other teachers demonstrated excellence, each with an average score of 100%, positioning them within the "excellent" practicality category. Furthermore, Teacher 3 obtained a commendable average score of 96.66%, signifying a "very good" practicality category. As a result, the overall average practicality score stands at 98.89%. The feedback from the 3 PE teachers primarily emphasizes the application's appeal and suitability for third grader students.

Next, the practicality test by students is conducted on third graders with 55 students from three different private schools in South Padang District. Student response tests are

carried out by providing assessment questionnaires. The results of the student response test were 55 people. The results of practicality tests by students are described in Table 6.

**Table 6.** The results of practicality test by student

| No. | Interval | F | % | Category | No |
|---|---|---|---|---|---|
| 1 | 81% – 100% | 53 | 96% | Very Good | 1 |
| 2 | 61% – 80% | 2 | 4% | Good | 2 |
| 3 | 41% – 60% | 0 | 0% | Moderate | 3 |
| 4 | 21% – 40% | 0 | 0% | Not Good | 4 |
| 5 | 0% – 20% | 0 | 0% | Bad | 5 |

According to the findings of the large-scale trial presented in Table 5, 55 students participated in completing the questionnaire. The assessed aspects garnered a highly positive response from all 55 learners, with the attained indicators achieving an average score of 96%.

### *3.5. Initial Product Revision Phase*

During this phase, enhancements are implemented on the recommendations and feedback provided by experts. The suggestions and input received for Construct 2-based learning media focusing on locomotor motion material primarily entail refining animation diversity and locomotor motion representation. These improvements aim to enrich the learning experience, ensuring a more engaging and comprehensive exploration of locomotor concepts for students.

## 4. Discussion

The role of teachers has become crucial in facing the demands of a rapidly changing era (Bojović et al., 2020; Sá & Serpa, 2020; Shin & Hickey, 2021). Teachers' digital literacy is the foundation of a successful learning process (Falloon, 2020; Khan et al., 2022; Quaicoe & Pata, 2020). The ability of teachers to use technology can increase interest in learning and help students achieve good achievements (Calderón et al., 2020; Zhao et al., 2021). Therefore, teachers must remain active in following technological developments to provide relevant learning by the demands of the times by utilizing technology.

Leveraging technology, such as developing learning media through Construct 2 software, presents a viable solution to enhance the efficiency of motion learning. This research proposes the development of interactive learning media for motion tools, where motion tools become the basic material in the lower grades, namely grade 3 primary school. The method used is Research and Development (R&D), involving media experts, material experts, PE teachers, and students as research subjects to test the validity and practicality of media.

It is proven that the development of application-based interactive learning media for locomotor motion material is feasible for use at the primary school level. Consistent with prior research by Kurniawan et al. (2022), application-based learning media is engageable for students. This finding is further supported by Isti'anah et al. (2023) research, demonstrating the feasibility of integrating Construct 2 software at the primary school level. In essence, integrating digital literacy, utilizing technology in learning, and fostering the development of technology-based media are pivotal for attaining the effectiveness and efficiency of education in the digital age. Teachers who understand and follow technological developments can provide appropriate and relevant education to the demands of the times, creating a pleasant learning atmosphere for students.

## 5. Conclusions

Based on the conducted research and development, it is evident that learning media utilizing Construct 2 software for locomotor motion exhibits an average of very good validity, with percentages of 97.42% for media and 99.24% for material. Furthermore, practicality assessments by three PE teachers yielded very good ratings, totaling 98.89%. Moreover, assessment results from 55 students showed an average score of 96%, indicating a

very good category. So, the developed media is suitable for use by PE teachers as teaching materials used for lower-grade children, especially third graders in primary schools. This learning media can be accessed via Android devices, enabling students to independently utilize it on their smartphones. However, this study has not assessed its effectiveness through larger-scale trials, indicating the necessity for further research to develop learning media, particularly for locomotor motion material at the primary school level.

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## 6. References

Ahmadi, F., Hardyanto, W., Pramono, S. E., Sugiarta, I. M., Syahputra, H., Kristanto, A., Parinsi, M. T., & Sugihartono, I. (2023). Developing mobile learning application containing basic pedagogy material as the supplement in improving college students' learning outcome in Teacher Training Institutes of Indonesia. *European Journal of Educational Research*, *12*(1), 213–227. https://doi.org/10.12973/eu-jer.12.1.213

Akayoğlu, S., Satar, H. M., Dikilitaş, K., Cirit, N. C., & Korkmazgil, S. (2020). Digital literacy practices of Turkish pre-service EFL teachers. *Australasian Journal of Educational Technology*, *36*(1), 85–97. https://doi.org/10.14742/ajet.4711

Alenezi, M. (2023). Digital learning and digital institution in higher education. *Education Sciences*, *13*(1). https://doi.org/10.3390/educsci13010088

Bartelds, H., Savenije, G. M., & van Boxtel, C. (2020). Students' and teachers' beliefs about historical empathy in secondary history education. *Theory and Research in Social Education*, *48*(4), 529–551. https://doi.org/10.1080/00933104.2020.1808131

Bojović, Ž., Bojović, P. D., Vujošević, D., & Šuh, J. (2020). Education in times of crisis: Rapid transition to distance learning. *Computer Applications in Engineering Education*, *28*(6), 1467–1489. https://doi.org/10.1002/cae.22318

Bonfield, C. A., Salter, M., Longmuir, A., Benson, M., & Adachi, C. (2020). Transformation or evolution?: Education 4.0, teaching and learning in the digital age. *Higher Education Pedagogies*, *5*(1), 223–246. https://doi.org/10.1080/23752696.2020.1816847

Calderón, A., Meroño, L., & MacPhail, A. (2020). A student-centred digital technology approach: The relationship between intrinsic motivation, learning climate and academic achievement of physical education pre-service teachers. *European Physical Education Review*, *26*(1), 241–262. https://doi.org/10.1177/1356336X19850852

Dube, B. (2020). Rural online learning in the context of COVID-19 in South Africa: Evoking an inclusive education approach. *Multidisciplinary Journal of Educational Research*, *10*(2), 135–157. https://doi.org/10.4471/remie.2020.5607

Dzikro, A. Z. T., & Dwiningsih, K. (2021). Kelayakan media pembelajaran berbasis laboratorium virtual pada sub materi kimia unsur periode ketiga. *Chemistry Education Practice*, *4*(2), 160–170. https://doi.org/10.29303/cep.v4i2.2389

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Hang, L. T., & Van, V. H. (2020). Building strong teaching and learning strategies through teaching innovations and learners' creativity: A study of vietnam universities. *International Journal of Education and Practice*, *8*(3), 498–510. https://doi.org/10.18488/journal.61.2020.83.498.510

Hariyanto, B. (2020). Pengembangan aplikasi Anola berbasis Android untuk pembelajaran atletik nomor lari jarak pendek. *Jurnal Didaktika Pendidikan Dasar*, *4*(2), 515–536. https://doi.org/10.26811/didaktika.v4i2.150

Isti'anah, I., Istiq'faroh, N., Murni, A. W., Lestari, W. M., Aini, N., Baalwi, M. A., & Kurniawati, R. (2023). Developing Construct 2 application-based online puzzle in teaching Pancasila symbols during Covid-19 outbreak for first graders of elementary school. *AIP Conference Proceedings*, *2679*. https://doi.org/10.1063/5.0112207

Jesionkowska, J., Wild, F., & Deval, Y. (2020). Active learning augmented reality for steam education—a case study. *Education Sciences*, *10*(8), 1–15. https://doi.org/10.3390/educsci10080198

Khan, N., Sarwar, A., Chen, T. B., & Khan, S. (2022). Connecting digital literacy in higher education to the 21st century workforce. *Knowledge Management & E-Learning*, *14*(1), 46–61. https://files.eric.ed.gov/fulltext/EJ1348223.pdf

Komaini, A., Hidayat, H., Ganefri, Alnedra, Kiram, Y., Gusril, & Mario, D. T. (2021). Motor learning measuring tools: A design and implementation using sensor technology for preschool education. *International Journal of Interactive Mobile Technologies*, *15*(17), 177–191. https://doi.org/10.3991/ijim.v15i17.25321

Kurniawan, A. W., Wiguno, L. T. H., & Maimunah, I. A. (2022). Application-based walking and running materials for middle school physical education. *Journal of Physical Education and Sport*, *22*(12), 2965–2973. https://doi.org/10.7752/jpes.2022.12374

Li, M., & Yu, Z. (2022). Teachers' satisfaction, role, and digital literacy during the COVID-19 pandemic. *Sustainability (Switzerland)*, *14*(3). https://doi.org/10.3390/su14031121

Nisa, I., & Suwardi, S. (2021). Stimulasi gerak lokomotor anak usia 1-4 tahun melalui metode gerak dan lagu. *Jurnal Anak Usia Dini Holistik Integratif (AUDHI)*, *1*(2), 88. https://doi.org/10.36722/jaudhi.v1i2.571

Oke, A., & Fernandes, F. A. P. (2020). Innovations in teaching and learning: Exploring the perceptions of the education sector on the 4th industrial revolution (4IR). *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(2), 31. https://doi.org/10.3390/JOITMC6020031

Palmizal, A., Pujianto, D., Nurkadri, & Laksana, A. A. N. P. (2020). Development of a creative gymnastics model to improve basic locomotor movements for students in elementary school. *International Journal of Human Movement and Sports Sciences*, *8*(6), 78–84. https://doi.org/10.13189/saj.2020.080714

Quaicoe, J. S., & Pata, K. (2020). Teachers' digital literacy and digital activity as digital divide components among basic schools in Ghana. *Education and Information Technologies*, *25*(5), 4077–4095. https://doi.org/10.1007/s10639-020-10158-8

Sá, M. J., & Serpa, S. (2020). The covid-19 pandemic as an opportunity to foster the sustainable development of teaching in higher education. *Sustainability (Switzerland)*, *12*(20), 1–16. https://doi.org/10.3390/su12208525

Samiaji, D. F., & Kurniawan, A. W. (2023). Pengembangan bahan ajar renang berbasis aplikasi construct untuk guru pendidikan jasmani, olahraga dan kesehatan. *MULTILATERAL : Jurnal Pendidikan Jasmani dan Olahraga* *22*(1), 13–27. http://dx.doi.org/10.20527/multilateral.v22i1.14660

Setiansah, M., Santoso, E., Novianti, W., & Fidinillah, D. A. (2023). Teacher digital literacy and the COVID-19 pandemic in Indonesia: Forced, used to it, return to before? *Res Militaris*, *13*(1), 4022-4034. https://resmilitaris.net/menu-script/index.php/resmilitaris/article/view/4000/3093

Sevil-Serrano, J., Aibar, A., Abós, Á., Generelo, E., & García-González, L. (2022). Improving motivation for physical activity and physical education through a school-based intervention. *Journal of Experimental Education*, *90*(2), 383–403. https://doi.org/10.1080/00220973.2020.1764466

Shin, M., & Hickey, K. (2021). Needs a little TLC: examining college students' emergency remote teaching and learning experiences during COVID-19. *Journal of Further and Higher Education*, *45*(7), 973–986. https://doi.org/10.1080/0309877X.2020.1847261

Sukmawijaya, F. M., & Fauzi, C. (2020). Design and Build desktop-based educational game save the wildlife "with game engine Construct 2. *Jurnal Mantik*, *4*(1), 149–158. https://iocscience.org/ejournal/index.php/mantik/article/view/722/480

Swanzy-Impraim, E., Morris, J. E., Lummis, G. W., & Jones, A. (2023). Exploring creative pedagogical practices in secondary visual arts programmes in Ghana. *Curriculum Journal*, *34*(4), 558–577. https://doi.org/10.1002/curj.201

Syaflin, H. M., Nurdin, F., Widiastuti, Syafaruddin, Lanos, M. E. C., & Syaflin, S. L. (2021). Basic locomotor motion characteristic design using games model for elementary school student. *International Journal of Human Movement and Sports Sciences*, *9*(3), 560–567. https://doi.org/10.13189/saj.2021.090323

Tabroni, I., Irpani, A., Ahmadiah, D., Riandy Agusta, A., Girivirya, S., & Ichsan. (2020). Impelemtation and strengthening of the literacy movement in elementary schools pasca the Covid-19 pandemic. *Multicultural Education*, *8*(1), 1–17. https://www.mccaddogap.com/ojs/index.php/me/article/view/15

van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2020). Measuring the levels of 21st-century digital skills among professionals working within the creative industries: A performance-based approach. *Poetics*, *81*(January), 101434. https://doi.org/10.1016/j.poetic.2020.101434

Wintle, J. (2022). Physical education and physical activity promotion: Lifestyle sports as meaningful experiences. *Education Sciences*, *12*(3). https://doi.org/10.3390/educsci12030181

Xie, B., Charness, N., Fingerman, K., Kaye, J., Kim, M. T., & Khurshid, A. (2020). When going digital becomes a necessity: Ensuring older adults' needs for information, services, and social inclusion during COVID-19. *Journal of Aging and Social Policy*, *32*(4–5), 460–470. https://doi.org/10.1080/08959420.2020.1771237

Yeşilyurt, E., & Vezne, R. (2023). Digital literacy, technological literacy, and internet literacy as predictors of attitude toward applying computer-supported education. *Education and Information Technologies*, *28*(8), 9885–9911. https://doi.org/10.1007/s10639-022-11311-1

Yuwono, C., Rahayu, T., Sulaiman, & Rustiadi, T. (2022). Increasing students' gymnastic and rhythmic activities through locomotor, non-locomotor, and manipulative movement patterns. *International Journal of Education in Mathematics, Science and Technology*, *10*(1). https://doi.org/10.46328/ijemst.2164

Zhao, L., Liu, X., & Su, Y. S. (2021). The differentiate effect of self-efficacy, motivation, and satisfaction on pre-service teacher students' learning achievement in a flipped classroom: A case of a modern educational technology course. *Sustainability (Switzerland)*, *13*(5), 1–15. https://doi.org/10.3390/su13052888