Validity and Reliability of Instruments in Physical Education Learning Multimedia

Adi S[1*], Tri Nurharsono[1], Bhayu Billiandri[1], Tommy Soenyoto[1]

[1] Universitas Negeri Semarang

Corresponding author: adis@mail.unnes.ac.id

Abstract: Some current studies need to conduct validity and reliability on these instruments. This study aims to measure the validity and reliability of learning multimedia tools. Instrument validation and reliability are determined using three quantitative methods with three main stages or steps, namely expert assessment (content validation), theory test (logical validation), and data test (construct validation). The research distributed questionnaires through Google Forms. Instrument validity data is based on the average score of the research subject's assessment. Media experts scored 92.68%, 90.5%, and 94.7% on three aspects. In contrast, material experts scored 89.50%, 88%, and 96% on three elements. KMO and MSA factor analysis tests covering three aspects produced values: The content aspect is 0.976, the learning/programming aspect is 0.962, and the display aspect is 0.978. The instrument's reliability, divided into three elements, is reliable because the Cronbach alpha value is higher than 0.7. The findings of this study provide new insights that multimedia development needs to be measured using the right instrument, the right instrument, valid and reliable. This research results in a multimedia evaluation instrument comprising content, appearance, learning, and programming. This research will undoubtedly provide positive things to evaluate multimedia in physical education.
Keywords: Validity, Reability, Multimedia Instrument, Learning, Physical Education

INTRODUCTION

The internet has changed people's lifestyles in a modern and digital direction (Nugroho et al., 2020). The majority of the study is conducted in Europe and Asia, and it offers tools to assess digital competence (Saltos-Rivas et al., 2020). The lifestyle of students in Indonesia is drastically changing as a result of internet usage. The need for technological advancements among pupils, which results in a workforce with lower skill levels, makes challenges in teaching and learning interesting. The creation and validation of a questionnaire was the primary goal of this study (Wafudu et al., 2022).

If an instrument measures what it is intended to measure, it is legitimate (Jackson, 2003). According to (Creswell & Guetterman, 2021; Jackson, 2003)., there are four sorts of validity: face, criterion, content, and construct. The test's face validity is its apparent reliability (Creswell & Guetterman, 2021). While content validity examines the item's content to determine whether it measures the concept being measured in the research, criterion validity is the concept that will be

demonstrated in the actual research because its establishment necessitates a thorough understanding of the theory relating to the concept and a measure of the relationship between our measure and those factors (Jackson, 2003). Construct validity, which examines how well an instrument captures the theoretical construct it is intended to measure, comes last.

According to (Jackson, 2003)., reliability refers to how free of measurement error test results are. It assesses the internal consistency or stability of an instrument when measuring a certain idea (Creswell & Guetterman, 2021). According to (Pallant, 2020), there are many levels of reliability based on how frequently the instrument is used and how many people contribute data. There are several types of dependability, including inter-rater reliability, alternate form and test-retest reliability, alternate form and test-retest reliability. When the same test is given to the same group of respondents twice and the correlation between the scores is examined, test-retest reliability is attained (Pallant, 2020). The instrument is more dependable the greater the correlation value. The degree to which results from one sample hold up when administered twice at various times using two different versions of the same instrument with the same concept is known as alternate form reliability. The two aforementioned ideas are combined in alternate form reliability and test-retest reliability. To confirm that all of the construct's components assess the same notion, internal consistency reliability examines the correlation between them all (Jackson, 2003). The last notion is inter-rater reliability, which examines whether results from a single sample are consistent when more than one observer uses the same instrument to record the respondent's behaviour simultaneously (Pallant, 2020).

In the Indonesian multimedia development study literature (Arrauf, 2016; Efendi, 2016; Setiawan, 2015; Sukiyandari, 2012; Titting, 2016), instruments can be used to independently identify learning difficulties (Cahyanto & Afifulloh, 2021). In some of these research, the tools employed must be standardised, have distinct questionnaire items, and are not valid and reliable. Every instrument has the potential to be accurate but not valid, although accuracy is a prerequisite for validity (Creswell & Guetterman, 2021). In other words, a tool must be trustworthy in order to be valid. Additionally, because validity evaluates information related to knowledge, it is generally more difficult to evaluate an instrument's validity than its reliability. On the other hand, consistency of scores is the only factor in reliability.

Assessment tools must have validity and reliability (Manurung et al., 2020). This requirement results from a deficiency in our environment's validation and quality of information management tools in digital contexts (Ramírez-Rodríguez et al., 2022). Multimedia learning cannot

be assessed using any measures. Some issues in the classroom go unanswered, particularly those involving connectivity (Sugiyono, 2021). This study created a web-based application to evaluate the accuracy and usability of free and accessible research tools for academics and researchers (Ovan & Saputra, 2020). The purpose of this study is to assess the reliability and validity of learning multimedia tools.

METHOD

Instrument validation and reliability were determined using three quantitative methods in significant phases or steps, which were expertly assessed (content validation), theory test (logical validation), and data test (construct validation). The study was conducted by distributing questionnaires via Google Forms.

Study Design

The study used a single-visit, cross-sectional descriptive design to evaluate the validity and reliability of the instrument. Qualitative methods are expert judgment (content validation), theory test (logic validation) and data test (construct validation). The study was conducted by distributing questionnaires through Google Forms.

Participants

Random cluster sampling was used as the sample method. This method is employed in light of the research population's dispersed position. Cluster sampling in two stages is the sample method employed. This method employs two sampling phases. The sample region is chosen in the first stage, and the local community is chosen in the second (Fika et al., 2021).

Twenty individuals took part in this investigation. Both professors and professionals in the media work as experts in their fields. Anyone who has been actively working with multimedia for at least a year is eligible for involvement in this study. Gender criteria are not used in this data collection.

The ethical approval for this study stipulated that participants must voluntarily choose to participate, have the option to withdraw at any time, have their anonymity protected, and have their personal information kept confidential. A permission document outlining the study's goals, methods, and participants' rights was provided to each participant before they could sign it. No additional

credit or reward was offered in exchange for participation. Over a two-month period, all study data were gathered.

Procedure

A questionnaire was used as the method of data collecting. Since communication during the COVID 19 pandemic was limited to in-person meetings, Google Forms were utilised. A reliability test (content validation), theory test (logic validation), and data test (construct validation) were used to validate this study. The reliability of the product was also evaluated at the same time using expert judgement. Expert judgement seeks to identify any flaws in the design so that it can be improved in accordance with the experts' recommendations. By gathering pertinent prior research to support current enquiry, theories are tested. The acquired data is processed using SPSS version 23 software and the percentage formula in order to perform the data test (construct validation). The following is a description of how expert judgement instruments and product practicality tests are classified:

20 questions made up the media expert grids, 20 questions made up the material expert grid, and 95 questions made up the trial evaluation to ascertain validity and reliability. A questionnaire with statements that are rated on a scale of one to ten (rating scale) is the instrument used in all stages and procedures of data gathering in expert judgement and product testing. A declaration regarding a given quality to be assessed by a number, followed by a score of the quality being measured, is known as a numerical rating scale.

The trial results are conducted on a modest scale, and the expert conducts the data from the validation stage. The reliability of the product is calculated using the percentage method instead of observation. In accordance with (Stewart et al., 2021), judgements can be made and the solution can be altered if the data is presented as percentages, proportions, and ratios. The data collected during the field trial stage was also subjected to factor analysis. This factor analysis includes the following items: Reducing pointless instrument elements is step one. Step two is gathering content, logic, and construct validity. The prerequisites have been satisfied, allowing for the collection of valid and reliable instruments (Rahmawati et al., 2018). The results that are invalid and unqualified (0–20%), less valid and qualified (2–40%), valid and moderately qualified (4–60%), valid and qualified (61–80%), and extremely valid and qualified (81–100%) are the expert assessment criteria employed (Firmansyah & Hariyanto, 2019).

Statistic Analysis

It is necessary to do the preconditioning test before moving on to the factor analysis of the created instrument items. It is possible to establish factor analysis in this way. Here are some prerequisite exams that need to be completed: 1) The Kaiser-Meyer-Olkin (KMO) test (Larassary, 2020) is used to determine whether factor analysis meets the requirements of 0.5-1.0 and is accurate. A score of less than 0.5 indicates that factor analysis needed to be done correctly. 2) The primary condition that must be met to use the KMO test, which is higher than 0.5, is the Measuring of Sampling Adequacy (MSA). Chi-Square employs Bartlett's Test Of Sphericity (Hanief & Purnomo, 2019) method, with a significant provision of less than 0.5. When the significance is more than 0.5, additional analysis is permitted; otherwise, it is not.

To make the calculating process more accessible, the validity test to assess the reliability of the evaluation tool was created using SPSS Version 23. Cronbach's alpha coefficient was employed in this study as the reliability test (Tomoliyus & Sunardianta, 2020). To assist researchers in understanding how reliable the measurement is. A dependability score of 0.70 or above meets the requirement. As a result, reliability can be seen as popular.

RESULTS

Five experts, including two media and three material experts, provided the information. The data can be utilised to support the conclusion that the produced instrument is appropriate for use and testing. Below are specifics regarding the accuracy of the information achieved:

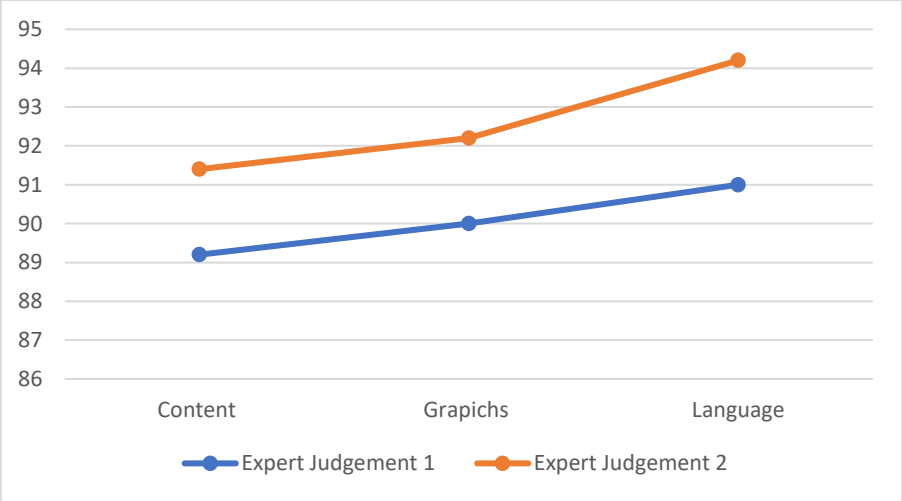


Figure 1. Media Expert Judgement

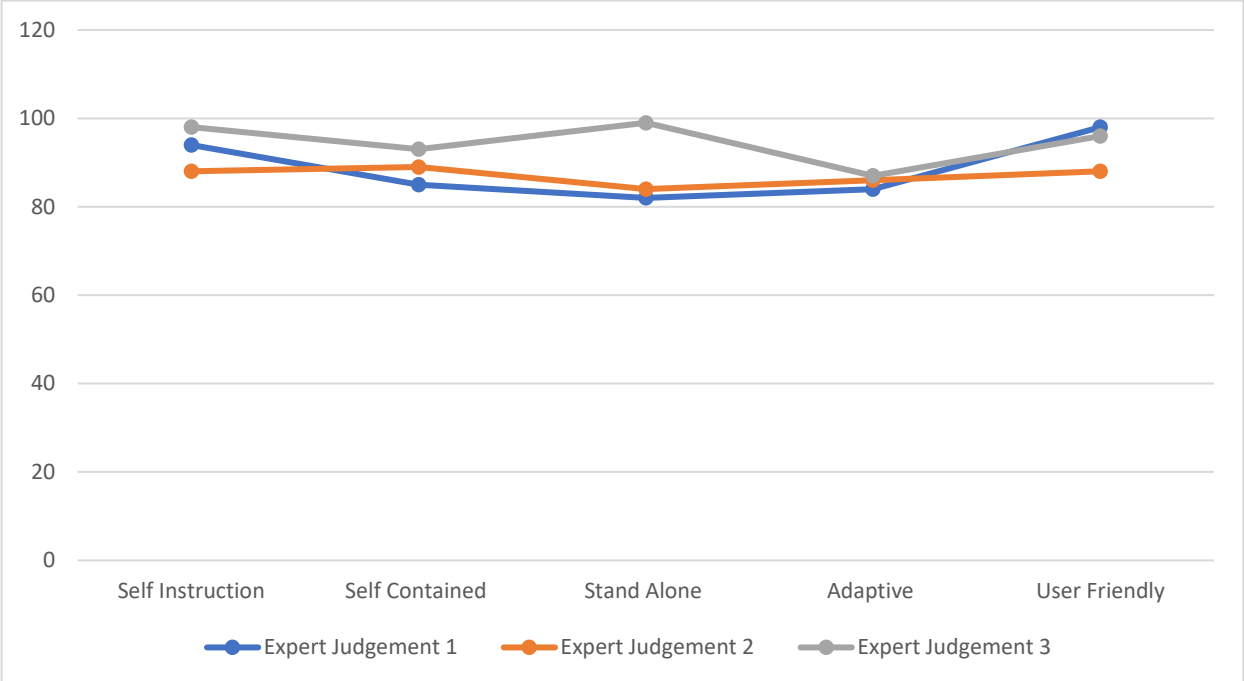


Figure 2. Material Expert Judgement

The data collected from media specialists (Figure 1) evaluated the dependability in the following ways: language reliability (91%), graphics (90%), and content (89.2%) reliability. Three material specialists provided further expert judgement data, with the following findings: self-instruction (94%, 88%, 98%), self-contained (85%, 89%, 93%), standalone (82%, 84%, 99%), adaptive (84%, 86%, 87%), and user-friendly (98%, 88%, 96%). The information gleaned from the evaluation of five experts—two media experts and three material experts—can be used to conclude that the instrument created is appropriate for usage and testing. The average score of media specialists in the areas of content reliability (92.68%), graphic reliability (90.5%), and linguistic reliability (94.7%) provide the specifics of the data of the instrument's dependability. While the first material expert (89.50%), second material expert (88%), and third material expert (96%), according to the data on the five aspects of self-instruction, self-contained, stand-alone, adaptive, and user-friendly (Figure 2), are the best. The information below was obtained using SPSS version 23 and relates to factor analysis, validity, and reliability. The Kaiser-Meyer-Olkin (KMO) Test, Measure of Sampling Adequacy (MSA), Bartlett's Test of Sphericity, and comparison of r count with r table for validity are used to conclude the factor analysis, validity, and reliability of the instruments used. Cronbach alpha is used to compare the coefficient to determine reliability.

The data analysis below is carried out on four instruments separated into three aspects: content, learning/programming and display. The data can be seen in detail in the figure below:

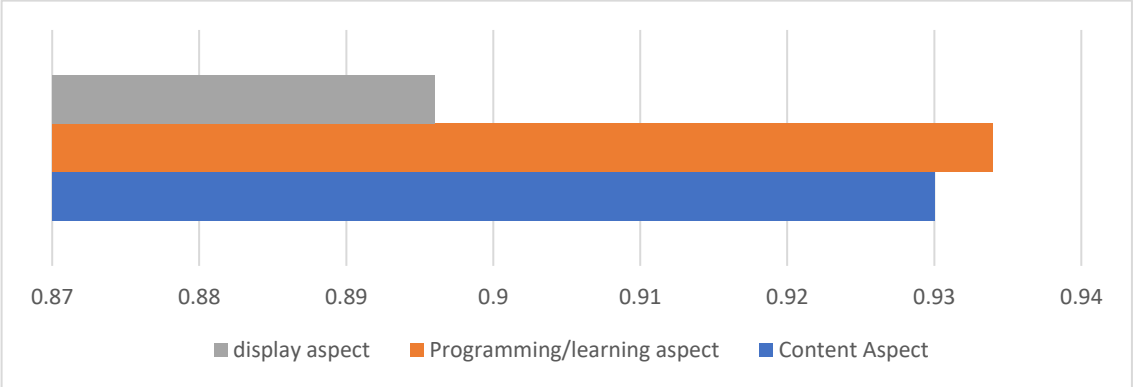
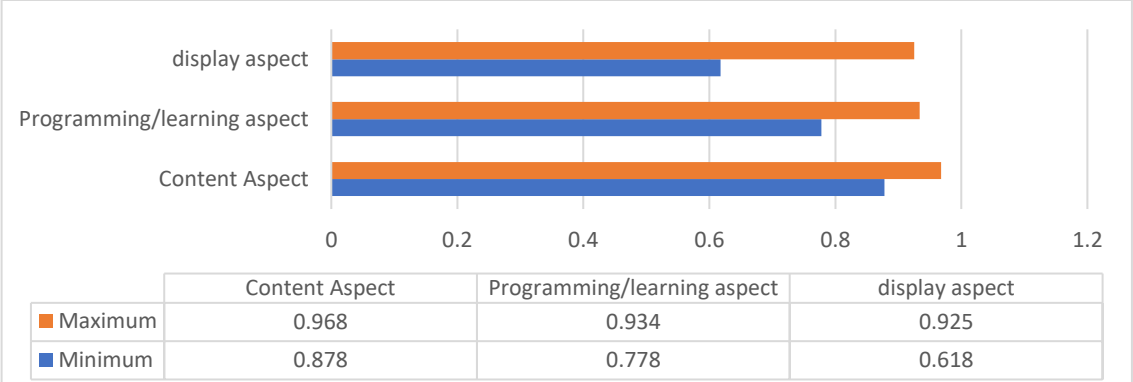


Figure 3. Analysing the factor of Kaiser Meyer Olkin (KMO) test, Measure of Sampling Adequacy (MSA).



	Content Aspect	Programming/learning aspect	display aspect
Maximum	0.968	0.934	0.925
Minimum	0.878	0.778	0.618

Figure 4. Validity test by using SPPS version 23

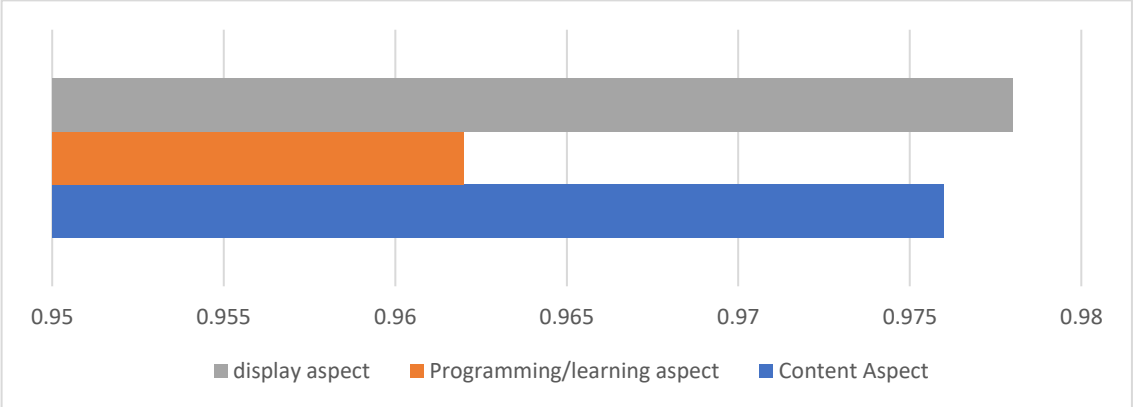


Figure 5. Reability Aspect

The data analysis findings indicate that the instrument can be further examined using the Kaiser-Meyer-Olkin factor analysis test and Measure of Sampling Adequacy (Figure 3), which can be used to examine the instrument's 0.930 content aspect, 0.934 learning/programming aspect, and 0.896 display aspect. After analysis, the instrument was deemed valid (Figure 4). There is a minimum and maximum score for this instrument for each aspect. The specific ranges for the three aspects are as follows: content: 0.878–0.968; learning/programming: 0.778–0.934; and display: 0.618–0.925. However, because the r count was lower than the r table, which was 0.389, two of

the instrument's questions had to be eliminated. On the other side, because the Cronbach alpha value is more than 0.7, the instrument's reliability, which is broken down into three components in Figure 5, is reliable. The learning/programming aspect was 0.962, the display aspect was 0.978, and the content aspect was 0.976.

DISCUSSION

The instrument can be deemed reliable and employed based on factor analysis, which requires several steps. These include 1) eliminating irrelevant instrument components and 2) ensuring content, logic, and construct validity. These requirements will be satisfied, leading to the production of an accurate and trustworthy device. This judgement is supported by information that has been meticulously gathered and examined. In this study, the evaluation of 5 experts—including two media experts and three material experts—was used to validate the content. The outcome of reasoning about instruments created using accepted theory is logical validation. While a summary that demonstrates how closely the test tool and theory align is acquired by testing using SPSS version 23. Given that (Jackson, 2003) specifies that the value must be more than 0.7 for a test to be considered internally consistent, this is considered reasonably acceptable. Furthermore, the factor load values on the factors were also extremely high, providing essential data for construct validity even when the researcher's meaningful interpretations were also considered.

The multimedia measured by the instrument is prepared to be used in the classroom to promote learning (Anggoro, 2020). According to recent studies (Nurabadi et al., 2022; Raof et al., 2021), the instrument used in this work is highly valid and reliable for use in actual research, reliable, and has a respectably high construct reliability coefficient (Combrinck & Inglis, 2020; Otaya et al., 2020).

The outcomes demonstrate that the tool may be applied to one of the data related to online learning when there is a learning assessment procedure (Cholifah et al., 2021). The instrument used for this survey has adequate reliability and validity (Liang et al., 2021; Loya & Dadgal, 2022) and is valid (Mohamad et al., 2022),. As a result, the instruments were validated using various techniques, including statistical validity, reliability, non-participant observation, and expert judgement (González-García et al., 2020). Our work takes one step further by including in this instrument a confirmatory factor analysis that is missing from other studies (Silva et al., 2022).

In (Li & Meng, 2021), the validity and reliability of the motivation and perception scales were examined. The Rasch Measurement Model assesses research instruments' unidimensionality

and validity (Suradi et al., 2020). E-self-assessment's validity and dependability (Febliza et al., 2021). Ensuring that every student complies with the standards (Salas-Delgado et al., 2022). In research (Bjørnsen et al., 2022; Mahanani et al., 2022; Yang et al., 2022) all mention using the developed instrument for evaluation. The tool can make future diagnoses because construct validity is assured (Bonifacio & Zuta, 2021).

Due to its ability to produce high-quality data and minimise measurement error, our completely validated questionnaire has proven valuable for research (Mallah et al., 2020; Sato et al., 2022). Assessing students' digital literacy abilities is beneficial to lessen teacher training bias (Rodriguez-Ruiz et al., 2021). There are no conclusions and multimedia formulations seen from teacher competency, which is a shortcoming of this study and a proposal for future research. The study's findings, which take the shape of a competency evaluation tool with three components for content, learning/programming, and display, will undoubtedly help assess learning multimedia. This study will have a significant influence on how education develops.

CONCLUSION

The findings of this research provide new insights into valid and reliable instruments. The result of this research is a competency evaluation instrument consisting of 3 aspects: content, learning/programming and display. This instrument is valid and reliable because it has met the predetermined prerequisites, namely expert judgment (content validation), theory test (logical validation) and data test (construct validation).

Conflict of Interest

There is no conflict of interest in this research.

REFERENCE

Anggoro, P. D. W. (2020). Design of Web Virtual Reality for Job Interview Preparation Simulation. *Lontar Komputer : Jurnal Ilmiah Teknologi Informasi; Vol 11 No 3 (2020): Vol. 11, No. 03 December 2020DO - 10.24843/LKJITI.2020.V11.I03.P02* . https://ojs.unud.ac.id/index.php/lontar/article/view/66040

Arrauf, N. (2016). *Pengembangan Multimedia Permainan Sepaktakraw Untuk Pembelajaran Penjasorkes di SMP Kabupaten Kulon Progo Yogyakarta*. Program Pascasarjana Unnes.

Bjørnsen, H. N., Moksnes, U. K., Eilertsen, M.-E. B., Espnes, G. A., & Haugan, G. (2022). Validation of the brief instrument “Health Literacy for School-Aged Children” (HLSAC) among Norwegian adolescents. *Scientific Reports*, *12*(1), 22057. https://doi.org/10.1038/s41598-022-26388-4

Bonifacio, E. N. C., & Zuta, P. M. (2021). E-learning teacher digital competence: construct

validation of a scale in times of pandemic. *2021 XVI Latin American Conference on Learning Technologies (LACLO)*, 209–215. https://doi.org/10.1109/LACLO54177.2021.00073

Cahyanto, B., & Afifulloh, M. (2021). Instrumen Self-Asessment Berbasis Self-Regulated Learning untuk Penilaian Keterampilan Dasar Mengajar Mahasiswa. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan; Vol 6, No 3: MARET 2021DO - 10.17977/Jptpp.V6i3.14608* .

Cholifah, P. S., Nuraini, N. L. S., Mahanani, P., & Rini, T. A. (2021). Designing Online Social Interaction Instrument Based on Assessment as Learning. *2021 7th International Conference on Education and Technology (ICET)*, 241–246. https://doi.org/10.1109/ICET53279.2021.9575067

Combrinck, C., & Inglis, H. M. (2020). The validity of international instruments for assessing South African engineering students. *2020 IFEES World Engineering Education Forum - Global Engineering Deans Council (WEEF-GEDC)*, 1–5. https://doi.org/10.1109/WEEF-GEDC49885.2020.9293636

Creswell, J. W., & Guetterman, T. C. (2021). *Educational research : planning, conducting, and evaluating quantitative and qualitative research* (Sixth, glo). Pearson Education Limited.

Efendi, A. (2016). *Pengembangan Multimedia Teknik Dasar Renang Pembelajaran Penjasorkes Sekolah Menengah Pertama di Kabupaten Kudus*. Program Pascasarjana Unnes.

Febliza, A., Afdal, Z., Copriady, J., & Futra, D. (2021). Enhancement of Quiz Moodle Feature in Developing e-Self Assessment Communication Skill. *2021 Universitas Riau International Conference on Education Technology (URICET)*, 356–362. https://doi.org/10.1109/URICET53378.2021.9865899

Fika, M., Soegiyanto, S., & Setyawati, H. (2021). Evaluation of Physical Education Online Learning of Junior High School During the COVID-19 Pandemic in Cepiring, Kendal Regency. *Journal of Physical Education and Sports*, *10*(3 SE-Articles). https://doi.org/10.15294/jpes.v10i3.49786

Firmansyah, G., & Hariyanto, D. (2019). The use of QR code on educational domain: a research and development on teaching material. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, *5*, 265. https://doi.org/10.29407/js_unpgri.v5i2.13467

González-García, A., Romero-Rodríguez, L.-M., Romero-Rodríguez, J.-M., & Ramírez-Montoya, M.-S. (2020). Validation of instruments to measure social entrepreneurship competence. The OpenSocialLab project. *2020 IEEE Global Engineering Education Conference (EDUCON)*, 1338–1342. https://doi.org/10.1109/EDUCON45650.2020.9125382

Hanief, Y. N., & Purnomo, A. M. I. (2019). Petanque: Apa saja faktor fisik penentu prestasinya? *Jurnal Keolahragaan; Vol 7, No 2: September 2019*. https://doi.org/10.21831/jk.v7i2.26619

Jackson, S. L. (2003). *Research methods and statistics: a critical thinking approach* . Thomson/Wadsworth.

Li, Q., & Meng, N. (2021). Design and Validation of an Online Collaborative Learning Motivation Scale for a PBL Translation Classroom. *2021 Tenth International Conference of Educational Innovation through Technology (EITT)*, 137–141. https://doi.org/10.1109/EITT53287.2021.00035

Liang, H.-W., Chi, S.-Y., Chen, B.-Y., & Hwang, Y.-H. (2021). Reliability and Validity of a Virtual Reality-Based System for Evaluating Postural Stability. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *29*, 85–91. https://doi.org/10.1109/TNSRE.2020.3034876

Loya, T. P., & Dadgal, R. (2022). Use of Smartphone Goniometer Application for Range of Motion Measurement in Different Joints: Review Article. *2022 International Conference on*

Connected Systems & Intelligence (CSI), 1–3. https://doi.org/10.1109/CSI54720.2022.9924042

Mahanani, P., Sutarno, Muchtar, Umayaroh, S., & Roebyanto, G. (2022). Development of Online Attitude Assessment Instruments Based on Character Education in Elementary School for Blended Learning. *2022 2nd International Conference on Information Technology and Education (ICIT&E)*, 316–321. https://doi.org/10.1109/ICITE54466.2022.9759893

Mallah, N., Rodríguez-Cano, R., Figueiras, A., & Takkouche, B. (2020). Design, reliability and construct validity of a Knowledge, Attitude and Practice questionnaire on personal use of antibiotics in Spain. *Scientific Reports*, *10*(1), 20668. https://doi.org/10.1038/s41598-020-77769-6

Manurung, A. S., Hasanah, M., & Siswanto, W. (2020). Instrumen Asesmen Berpikir Kritis Dalam Pembelajaran Membaca Teks Eksposisi untuk Siswa Kelas VIII SMP. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan; Vol 5, No 6: JUNI 2020DO - 10.17977/Jptpp.V5i6.13583* . http://journal.um.ac.id/index.php/jptpp/article/view/13583

Mohamad, M., Damayanti, N., Abualrejal, H. M., Yusoff, Y. M., & Zakaria, I. H. (2022). Assessment on the Quality of Outer Model in Path Model for MOOC Instrument. *2022 International Conference on Intelligent Technology, System and Service for Internet of Everything (ITSS-IoE)*, 1–5. https://doi.org/10.1109/ITSS-IoE56359.2022.9990936

Nugroho, H., Irmina, M., & Wijayanti, R. (2020). An Evaluation of Internet Addiction Test (IAT). *2020 Fifth International Conference on Informatics and Computing (ICIC)*, 1–6. https://doi.org/10.1109/ICIC50835.2020.9288561

Nurabadi, A., Triwiyanto, T., Gunawan, I., Valenda, O. Y., Pribadi, S. A., Darmawan, A., Nabila, A. W., Baharudin, A., Krisnafitriana, V., & Wardani, A. D. (2022). Assessing Validity and Reliability of an Instrument for Measuring Student Digital Leadership: Example from Indonesia. *2022 8th International Conference on Education and Technology (ICET)*, 288–292. https://doi.org/10.1109/ICET56879.2022.9990863

Otaya, L. G., Kartowagiran, B., & Retnawati, H. (2020). The construct validity and reliability of the lesson plan assessment instrument in primary schools. *Jurnal Prima Edukasia; Vol 8, No 2: July 2020DO - 10.21831/Jpe.V8i2.33275* . https://journal.uny.ac.id/index.php/jpe/article/view/33275

Ovan, O., & Saputra, A. (2020). CAMI: Web-Based Application to Test Validity and Reliability of Research Instruments. *JETL (Journal of Education, Teaching and Learning); Vol 5, No 2 (2020): Volume 5 Number 2 September 2020DO - 10.26737/Jetl.V5i2.2032* . https://journal.stkipsingkawang.ac.id/index.php/JETL/article/view/2032

Pallant, J. (2020). *SPSS survival manual : a step by step guide to data analysis using IBM SPSS / Julie Pallant.* (7th ed.). Routledge.

Rahmawati, L., Utomo, U., & Ahmadi, F. (2018). the Development of Assessment Instruments Skills of Cultural Lesson Arts and Workshops in Primary School Based on Mobile. *Journal of Research and Educational Research Evaluation*, *7*(1), 60–69.

Ramírez-Rodríguez, L. T., Sanchez-Pimentel, J. I., Osorio-Galván, R. C., & Pérez-Ortiz, J. O. (2022). Design and Validation of an Instrument to Measure Digital Skills in University Students of the First Cycles of Health Careers. *2022 IEEE 2nd International Conference on Advanced Learning Technologies on Education & Research (ICALTER)*, 1–4. https://doi.org/10.1109/ICALTER57193.2022.9964660

Raof, S. A., Musta'amal, A. H., Zamzuri, F. K., & Salleh, M. H. (2021). Validity and Reliability of Students Perceptions on OBE Approach in Malaysian VC Using Rasch Model. *Journal of Innovation in Educational and Cultural Research; Vol 2, No 2 (2021)DO - 10.46843/Jiecr.V2i2.30* . http://jiecr.org/index.php/jiecr/article/view/30

Rodriguez-Ruiz, J., Alvarez-Delgado, A., & Caratozzolo, P. (2021). Use of Natural Language Processing (NLP) Tools to Assess Digital Literacy Skills. *2021 Machine Learning-Driven Digital Technologies for Educational Innovation Workshop*, 1–8. https://doi.org/10.1109/IEEECONF53024.2021.9733779

Salas-Delgado, M. V, Portilla-Vilca, E., Chara-Barreda, C., & Turpo-Rodríguez, A. M. (2022). Level of the dimensions of the digital competence in university students from different academic areas. *2022 XII International Conference on Virtual Campus (JICV)*, 1–4. https://doi.org/10.1109/JICV56113.2022.9934373

Saltos-Rivas, R., Novoa-Hernández, P., & Rodríguez, R. S. (2020). On the Reliability and Validity of Digital Competence Evaluation in Higher Education. *2020 39th International Conference of the Chilean Computer Science Society (SCCC)*, 1–8. https://doi.org/10.1109/SCCC51225.2020.9281279

Sato, M., Osawa, T., Abe, T., Honda, M., Higuchi, M., Yamada, S., Furumido, J., Kikuchi, H., Matsumoto, R., Sato, Y., Sasaki, Y., Harabayashi, T., Maruyama, S., Takada, N., Minami, K., Tanaka, H., Morita, K., Kashiwagi, A., Murai, S., … Shinohara, N. (2022). Validation of the Japanese version of the Body Image Scale for bladder cancer patients. *Scientific Reports*, *12*(1), 21544. https://doi.org/10.1038/s41598-022-25669-2

Setiawan, M. R. (2015). *Pengembangan Aktivitas Ritmik Berbasis Multimedia Pada Pendidikan Jasmani, Olahraga dan Kesehatan Di Sekolah Menengah Kejuruan (SMK) Kabupaten Ogan Komering Ulu (OKU) Selatan Provinsi Sumatera Selatan*. Program Pascasarjana Unnes.

Silva, L., Mendes, A. J., Gomes, A., Lam, C. T., Chan, C., & Fortes, G. (2022). Reliability and Predictive Validity of the Self-regulation Programming Strategies Questionnaire. *2022 International Symposium on Computers in Education (SIIE)*, 1–6. https://doi.org/10.1109/SIIE56031.2022.9982352

Stewart, E., Stewart, M., Kodithuwakku Arachchige, S. N. K., Turner, A., Burch V, R. F., Knight, A., Johnson, J., Younger, T., & Chander, H. (2021). Validation of a bat handle sensor for measuring bat velocity, attack angle, and vertical angle. *International Journal of Kinesiology and Sports Science*, *9*(2), 28–32. https://doi.org/10.7575/aiac.ijkss.v.9n.2p.28

Sugiyono, S. (2021). The evaluation of facilities and infrastructure standards achievement of vocational high school in the Special Region of Yogyakarta. *Jurnal Penelitian Dan Evaluasi Pendidikan; Vol 25, No 2 (2021)DO - 10.21831/Pep.V25i2.46002* . https://journal.uny.ac.id/index.php/jpep/article/view/46002

Sukiyandari, L. (2012). *Pengembangan Multimedia Pembelajaran Bolabasket Dalam Mata Pelajaran Pendidikan Jasmani Olahraga Dan Kesehatan Bagi Siswa SMA Se Kota Semarang*. Program Pascasarjana Unnes.

Suradi, N. R. M., Kahar, S., & Jamaludin, N. A. A. (2020). Validation of a Web-based Integrated Student Assessment Application Questionnaire in Public Institution: A Rasch Analysis Approach. *2020 6th International Conference on Interactive Digital Media (ICIDM)*, 1–5. https://doi.org/10.1109/ICIDM51048.2020.9339598

Titting, F. (2016). *Pengembangan Multimedia Pembelajaran Senam Lantai Berbasis Android Pada Pendidikan Jasmani, Olahraga Dan Kesehatan Disekolah Menengah Atas*. Program Pascasarjana Unnes.

Tomoliyus, T., & Sunardianta, R. (2020). Validitas Aiken's instrumen tes untuk mengukur reaktif agility olahraga khusus tenis meja. *Jurnal Keolahragaan*, *8*. https://doi.org/10.21831/jk.v8i2.32492

Wafudu, S. J., Kamin, Y. Bin, & Marcel, D. (2022). Validity and reliability of a questionnaire developed to explore quality assurance components for teaching and learning in vocational and technical education. *Humanities and Social Sciences Communications*, *9*(1), 303.

https://doi.org/10.1057/s41599-022-01306-1
Yang, J., Ou, Z., Mao, Z., Wang, Y., Zhong, Y., Dong, W., Shen, Z., & Chen, Z. (2022). Reliability and validity of Foot Posture Index (FPI-6) for evaluating foot posture in participants with low back pain. *Scientific Reports*, *12*(1), 21168. https://doi.org/10.1038/s41598-022-22220-1