



Determining the Validity and Reliability of ArtSci-S.P.D. Module on Year 5 Human Circulatory System

Kai Ling Ng^{1ABCD} and Syakirah Samsudin^{1ABCD}

¹Universiti Pendidikan Sultan Idris

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Objectives. The study aimed to determine the validity and reliability of the developed art-integration in science learning module, named ArtSci-S.P.D. Implementing the module has been carried out in order to ensure its suitability for using in further research.

Materials and methods. The analysis approach for face validity was Fleiss' kappa, while the content validity index (CVI) was employed to assess content validity, and the test-retest reliability method was used for measuring reliability. The calculation of test-retest reliability was performed by using Pearson's correlation coefficient.

Results. The findings show a positive tendency for evaluating the face and content validity (Fleiss' kappa, $k = 0.66$; $CVI > 0.78$). Additionally, the module exhibits a high coefficient of reliability ($r = 0.87$).

Conclusions. Thus, the module has been considered to be a valid and reliable tool for using in the actual study, thereby underscoring its efficacy.

Keywords: science-art integration, learning module, validity, reliability, test-retest reliability, Pearson's correlation.

Introduction

Science is an interesting and fun subject which is provided from primary school that should be learned by the students from the time they are young until the university level. In Malaysia, enrollment of science learning is gradually decreasing as there are some issues dealing with students' learning motivation and their learning styles (Munawaroh et al., 2022; Sudarman & Ardian, 2021; Balakrishnan et al., 2019; Mahamod & Somasundram, 2017). Due to this, the concept of 'teach for test' does not work anymore in which the students' learning should not learn because of aiming to get good results; but it is crucial to ensure that students learn for the sake of learning (Yashinsky, 2023).

Understanding the learning styles of students is essential for designing effective instructional methods and supporting learners with diverse needs (Idris et al., 2023). Effective learning happens when the learners are being active and highly motivated to obtain the knowledge (Ferlazzo, 2021; Hennessey, 2019). However, in some of the schools, the teachers are still using the traditional ways of teaching which causes the students to be bored in class (Keiler, 2018). This is because the teachers lack of skills in developing or creating new learning material or methods (Balakrishnan et al., 2019). The use of textbooks is no longer attractive for the students to learn;

therefore, the teachers or educators should provide different ways of learning which promotes interactive, active engaging lessons (Hartikainen et al., 2019; Freeman et al., 2014).

In addition, the teachers who rush for the syllabus also make the students lose their motivation to learn because they are unable to catch up on the notes, or not having enough time to understand the whole concept (The Star, 2023; The Straits Times, 2021; Mahamod & Somasundram, 2017). This makes the students reduce their interest in learning science. According to Keiler (2018), teacher-centred lessons with 'talk and chalk' caused the students to be passive learners. Therefore, in this study, an educational tool which is a Science-integrated with Art learning module has been developed, named "ArtSci-S.P.D. Module". As this module promotes a student-centred, active learning approach – where the students are encouraged to learn by experiences on their own.

According to Lawrence, Lim and Haslinda (2019) as cited in Ling et al. (2024), the approach of teaching and learning in a lesson will gradually experiences changes and shifts in the future, because this action is to keep up with the pace of students' development in terms of academic or personal learning skills, which aiming to improve their knowledge and skills that necessary to adapt to 21st century era. Therefore, interdisciplinary is beneficial in helping with this issue.

The learning of science using/with art is a more integrated method of learning, which can enhance a more students-

centred and active learning which give positive impact on students' learning, allowing them to explore knowledge; at the same time, to develop the 21st century skills needed for the future (Ling et al, 2024). Students' involvement in the learning process is important when they are able to experience the learning by hands-on activity or Doing, the learning becomes meaningful (Dewey, 1988). Thus, the Art-Integration in Science learning which promotes hands-on experiences, helps in allowing the students to learn and understand more when doing the artworks.

Background of Study

The paper aims to discuss the validity and reliability of the ArtSci-S.P.D. Module obtained. The ArtSci-S.P.D. module, a learning module developed for this research on Year Five Human Circulatory System, a topic that is under the Malaysian National Year Five Primary Curriculum (KSSR) Science syllabus. It is a module that uses the idea of Art-Integration in Science learning. It promotes hands-on and learning-by-doing concepts. This module uses the Malay language medium because it is developed for Year Five students who study at Malaysian National Primary School or 'Sekolah Rendah Kebangsaan (SK)'. This module will then be used in the real study later for investigating the effectiveness and usability of the module. Thus, it is important to check its validity and reliability before the module is used in real study.

Objectives

In this study, the objectives of this study are as follows:

- (I) Determine the validity of the ArtSci-S.P.D. Module of Year 5 Human Circulatory system.
- (II) Determine the reliability of ArtSci-S.P.D. Module of Year 5 Human Circulatory system.

Materials and Methods

The design of the study is a quantitative method. The validity of the module is determined by the experts in the relevant field of expertise and the reliability of the module is determined by the sample students who are involved in a pilot study.

A good instrument can be established through the analysis of validity and reliability (Masuwai, Zulkifli & Hamzah, 2024). The ArtSci-S.P.D. Module is an instrument that will be used for measuring the aim of real research later. Therefore, it is vital to evaluate the module's validity and reliability to ensure it is relevant and suitable to be used in real study later (Sundram & Romli, 2023; Sürücü & Maslakçi, 2020; Taherdoost, 2016).

Validity of Module

Validity refers to whether the measuring instrument does what it is supposed to measure and performs as intended (Sudaryono et al., 2019; Creswell, 2012). According to Chua et al. (2020), the validity of a module refers to assessment on the module in terms of its accuracy of concepts and contents in the module. In this study, face validity and content validity are both tests used to evaluate the validity of the module.

Three panels who are experts in language and educational evaluation selected for assessing the face validity and seven experts for content validity panels based on their expertise in science or visual art education. The responses of each panel are collected using the questionnaire; Face Validation Form and Content Validation Form. Table 1 shows the panel list for the validation process of ArtSci-S.P.D. module.

Table 1. Panel list for face and content validity assessment on module

Expert	Field of expertise/Position	Working Years	Validation process
A	Malay language/ Lecturer	16	Face Validity
B	Malay language & Visual Art/ Primary school teacher	10	Face Validity Content Validity
C	Educational Measurement and Evaluation / Lecturer	17	Face Validity
D	Science(primary school)/ Senior teacher	16	Content Validity
E	Science(primary school)/ Teacher	26	Content Validity
F	Science(primary school)/ Teacher	15	Content Validity
G	Science(primary school)/ Teacher	7	Content Validity
H	Science(primary school)/ Teacher	18	Content Validity
I	Visual Art/ Senior teacher	21	Content Validity

The judgement of the validity test is based on the appropriateness, meaningfulness and ambiguity of each question to determine how accurately the questionnaire taps into the various aspects of the construct questions. For the face validation of the module, the responses are collected using "Agree" or "Disagree" scales, the data is then analysed by Fleiss' kappa method. Fleiss' kappa is a statistical method used to measure the inter-rater agreement or reliability of agreement between multiple raters (more than two raters) on a measured scale (Fleiss, 1971; Fleiss, Levin & Paik, 2003).

While, for the content validation, the agreements of experts are collected using a Four-points Likert scale: Strongly Disagree (1), Disagree (2), Agree (3) and Strongly Agree (4). There are 16-item asking about the experts' opinion on the content in the module including the instruction part, learning objectives, suitability of image, notes, exercise and visual art activity. The data is then analysed by Content Validity Index (CVI) as proposed by Polit, Beach and Owen (2007).

The content validity index is a measure of inter-rater agreement commonly used to calculate the level of agreement among raters (Moustafa, 2020). According to Lynn (1986), the minimum level of CVI between five and 10 validators is at ≥ 0.78 , that means if the CVI less than 0.78 needs to be revised. Table 2 shows the acceptable cut-off value of I-CVI and S-CVI/Ave for seven experts (Polit et al., 2007; Waltz et al., 2005).

Table 2. Acceptance of CVI value and its Interpretation

Acceptable value of CVI	Interpretation
Value of I-CVI	Excellent
At least 0.83 (should not less than 0.78)	
Value of S-CVI/Ave	Excellent
0.90	

Reliability of Module

The reliability of ArtSci-S.P.D. Module was assessed through a pilot study with 27 sample students. The data of pilot use of the module is collected based on the Pre-test and Post-test. The score of Pre-test and Post-test intended to check for the reliability of the module (May & Ahmad, 2018). The data is analysed using the test-retest reliability method to obtain the value of Pearson's correlation coefficient, r on a value between -1 and 1.

According to Cronk (2024) and Kennedy (2022), test-retest reliability refers to a test of 'stability' which provides an indication of stability measurement and consistency of an instrument over time. A measure is said to have high reliability if it produces similar results under consistent conditions (Oktavia et al., 2018). The analysis using Pearson's correlation indicates whether there is a linear relationship between the scores of pre-test and post test (May & Ahmad, 2018). This linear relationship can be a positive or negative relationship (Schober et al., 2018). The degree of Pearson's correlation can be interpreted as follows in Table 3 (Cronk, 2024).

Table 3. Indicator of Pearson's correlation coefficient

r value	Interpretation
$ r \geq 0.7$	High degree of relationship (Strong Correlation)
$0.3 \leq r < 0.7$	Moderate degree of relationship (Moderate Correlation)
$ r < 0.3$	Low degree of relationship (Weak Correlation)
0	No relationship or Correlation

The Pre-test was given to the samples at the one week before starting using the module to learn, then three weeks of usage of the module to learn. At the end of the period of study, the Post-test was given to the samples. This method involves administering the same test to the same group of participants at two different points in time, then comparing the results to determine the consistency of the module's performance. Overall, the reliability test of the module (pilot study) took around four weeks to complete.

Results and Discussion

Validity of ArtSci-S.P.D. Module

The module is being evaluated for the face validity and content validity. The validation is done by the selected experts. Table 4 shows the response from three experts in evaluating the Module's Face Validity and Table 5 shows the comments about the overall of the module in terms of accuracy and appropriation.

Based on the comments from experts, the researcher had made some modifications to the module in order to make sure that the module is appropriate to be used in actual study.

Table 6 shows the results of Fleiss' kappa. According to Fleiss et al. (2003), Fleiss' kappa is the extension of Cohen's kappa where the value of 0.75 and greater is considered excellent agreement between panels and $0.40 < k < 0.74$ is acceptable and indicated good strength of agreement.

The content validation process was done by seven experts. Table 7 presented the results of the content validity of the ArtSci-S.P.D. Module. Based on the table, the value of both CVI (I-CVI and S-CVI) indicates the module's content is valid.

Table 4. ArtSci-S.P.D. Module's Face Validity

Evaluation Item	Expert A	Expert B	Expert C
Appropriate and attractive format and layout	1	1	1
Appropriate and attractive colour used in the module	1	1	1
Suitable font size	1	1	1
Suitable font type	1	1	0
There are no spelling mistakes	0	0	0
Appropriateness of grammar	0	0	0
Use of simple language	1	1	1
Appropriate sentence structure	1	0	1
Relevant text arrangement	1	1	1
Appropriate and attractive visuals and pictures in the module	1	1	1

*Note: '0' indicates Disagree; '1' indicates Agree

Table 5. Panels' comments on Improvement of the ArtSci-S.P.D. Module

Expert	Comments
A	- Please refer to the spelling correction in the module as I written down - Sentences has a little problematic, recommended to rearrange
B	There are some spelling mistakes in the module, please refer.
C	- Some font size is quite small to read by the kids - There is quite a lot of different font type used in the module

Table 6. Results of Face Validity of ArtSci-S.P.D. Module

Fleiss kappa, k	Interpretation
0.659	Good

Based on results above, it shows a strong agreement among the seven panels on the content validity of module. As Polit et al. (2007), Waltz et al. (2005) and Lynn (1986) commented that the value of I-CVI should be at least 0.83; thus, the obtained I-CVI value at table above are considered pass the cut-off points. Next, the S-CVI for overall of the content validity of module also achieved a excellent level of agreement. Therefore, the ArtSci-S.P.D. Module has a good content validity.

Reliability of ArtSci-S.P.D. Module

For the reliability test of ArtSci-S.P.D. Module analysed by test-retest reliability using Pearson's correlation. According to Cronk (2024), Pearson's correlation coefficient can tell the how strong is level of relationship between the scores. By using the test-retest reliability method, if there is a relationship occurs, this is meaning that the module is showing 'stability' over time. Based on the results obtained, the Pearson's correlation coefficient is $r = 0.868$ where this value indicates it is strong positive correlated ($|r| \geq 0.7$) and significantly different from zero ($p < 0.001$). There is significant correlation between the test scores obtained for the Pre-test and Post-test. Thus, as the data indicate, the ArtSci-S.P.D. Module possess

Table 7. Results of Content Validity of ArtSci-S.P.D. Module

Items	Expert in agreement	I-CVI	Interpretation
Introduction	7	1	Excellent
Table of Contents	7	1	Excellent
Learning Objectives are clearly stated.	7	1	Excellent
Contents of each subtopic in the module are appropriate and relevant.	7	1	Excellent
Facts and knowledge that given able to fulfil the content and objectives of teaching topic.	7	1	Excellent
Learning activities that given able to measure the learning objectives.	7	1	Excellent
The extra notes that were added are appropriate for learning the topic of human circulatory system.	7	1	Excellent
The 'Fun-facts' and 'Do you know' are appropriate.	7	1	Excellent
Reinforcement activities [on pg 6, 9, 18, 22, 27] are appropriate.	7	1	Excellent
Reinforcement activities are able to measure the learning objectives.	7	1	Excellent
The ArtSci activities 1, 2, 3 and 4 are appropriate with the content of subtopics.	7	1	Excellent
Clear instructions for ArtSci activities 1, 2, 3 and 4.	6	0.86	Excellent
The ArtSci activities 1, 2, 3 and 4 are fun and interesting.	7	1	Excellent
All QR codes are functioning.	7	1	Excellent
All QR codes are suitable for the contents.	7	1	Excellent
Contents in the module are easy to understand.	7	1	Excellent
S-CVI/Ave		0.99	Excellent

adequate stability and significant reliability. Table 8 shows the results of Pearson's correlation coefficient between Pre- and Post-Test scores of pilot study – reliability of this module.

Table 8. Pearson Correlation (Test-Retest Reliability test)

	Pearson Correlation	Significance (2-tailed)
Pre-Test	r = 0.868	< 0.001
Post-Test		

Conclusions

The validity and reliability process are important steps to be taken to evaluate the instrument before the instrument being used in the actual research. In this study, validation on the face and content of the developed module, named ArtSci-S.P.D. Module has been assessed by selected experts. Based on the results obtained, the module shows a good, valid result on its validity test ($k = 0.66$; $CVI > 0.78$). Besides that, the module also measured the reliability of the module using the test-retest reliability with obtaining a high reliability value of $r = 0.87$ ($r \geq 0.70$). Thus, the ArtSci-S.P.D. Module is tested valid and reliable, accepted to be used in the actual study for measuring its effectiveness and usability.

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Визначення валідності та надійності застосування модуля з інтеграції мистецтва в науково-освітній процес (ArtSci-S.P.D.) щодо вивчення системи кровообігу людини на 5-му році навчання шкільної освіти

Кай Лінг Нг^{1ABCD}, Сякіра Самсудін^{1ABCD}

¹Педагогічний університет Султана Ідріса

Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 6 с., 8 табл., 34 джерел.

Мета дослідження. Мета дослідження полягала у визначенні валідності та надійності розробленого навчального модуля з інтеграції мистецтва в науково-освітній процес, що позначається як ArtSci-S.P.D. Впровадження модуля проведено задля підтвердження доцільності його застосування в подальших дослідженнях.

Матеріали та методи. В якості підходу до аналізу очевидної валідності використовувався показник каппа Флейса, тоді як для оцінки валідності змісту застосовувався індекс валідності змісту (ІВЗ), а для вимірювання надійності — метод тест-ретестової надійності. Розрахунок тест-ретестової надійності здійснено за допомогою коефіцієнта кореляції Пірсона.

Результати. Отримані дані свідчать про позитивну тенденцію щодо оцінки очевидної та змістової валідності (каппа Флейса, $k = 0,66$; ІВЗ $> 0,78$). Крім того, модуль має високий коефіцієнт надійності ($r = 0,87$).

Висновки. Таким чином, зазначений модуль вважається валідним і надійним інструментом з точки зору застосування в рамках актуального дослідження, що підкреслює його ефективність.

Ключові слова: інтеграція науки і мистецтва, навчальний модуль, валідність, надійність, тест-ретестова надійність, кореляція Пірсона.

Information about the authors:

Ng, Kai ling: kl.master.use@gmail.com; Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, 35900, Malaysia.

Samsudin, Syakirah: syakirah@fsmu.upsi.edu.my; <https://orcid.org/0000-0002-3676-5393>; Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, 35900, Malaysia.

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