Construct validity of digital media literacy instrument for student teachers

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Abstract. To measure the level of media literacy, a measuring instrument in the form of an assessment is needed. The instruments used in the study were adopted from Son which is a non-test in the form of a closed questionnaire that had been revised and validated with the conditions of students in Banda Aceh. The study aims to examine construct validity of digital media literacy instruments used. The population in the study was 242 student teachers in Biology Education Department at a public university in Banda Aceh. The sample were 168 students selected using purposive sampling. The study applied CFA method. The results of construct validity of the instrument that can be seen in the validity of all the observed variables were good with $t_{value} > 2$ and SLF >0.3. Moreover, the construct reliability were categorized very high (0.80<CR 1.00) and high (0.60<CR0.80). This indicates that the instrument can be used to measure the level of digital media literacy of student teachers.

1. Introduction
Digital media literacy is the ability to access, manage, evaluate, create new information, and communicate information obtained from digital media. The digital media literacy can protect students from negative impacts caused by digital media. The purpose of digital media literacy is to give someone an understanding of the benefits and disadvantages of digital media so that they are able to be critical of media content [2,3]. As a result, students will be able to think critically, logically, and easily believe in information obtained through digital media. Research related to digital media literacy is mostly done in various fields, such as information, communication, and education and other fields depending on the research context [4]. Media literacy can help individuals of various ages to enhance the abilities and investigations needed to become critical thinkers, effective communicators and active citizens [5]. Some aspects of digital media literacy, such as the ability to search, browse, process, and evaluate information must be possessed as basic knowledge in sharing knowledge to students [6,7].

To measure the level of media literacy, a measuring instrument in the form of an instrument is needed. The use of assessment in literacy level research has been carried out by [8], which stated that the level of media literacy is at the medium level, meaning that the students’ ability to operate, use media, evaluate, and participate in the media has been good enough. In this study, literacy level instruments used are found by [10] which has indicators namely; computer and digital skills, use of digital technology, understanding digital media literacy, and understanding factors that influence digital media technology. The instrument is translated into Indonesian and needs to be re-evaluated.
(factor analysis) of its construct due to the differences in the culture of a country, including the literacy culture that affects the instrument. Factor analysis is used to obtain preliminary data in order to establish policies relating to education. Digital media literacy is considered necessary as basic knowledge and preparation for dealing with information from various types of digital media. It is hoped that this research can be a foundation for compiling and mapping integrated learning in the 21st century dominated by technology as well as a reference to develop students’ skills regarding digital media, build methods and develop learning processes that can help them to obtain correct and accurate information.

2. Method
This research was conducted from November 2018 to January 2019 at Biology Education Department, Teachers Training and Education Faculty Universitas Syiah Kuala and Ar-Raniry State Islamic University in Banda Aceh. The approach used in the study was factor analysis using Confirmatory Factor Analysis (CFA) through the Path Diagram method [9]. The study applied explanatory method, which is useful for testing a theory in strengthening and even rejecting existing research.

The instruments used in the study were adopted from Son [10] which is a non-test in the form of a closed questionnaire that had been revised and validated with the conditions of students in Banda Aceh. The population in this study was 242 students enrolled in Biology Education Department at public universities in Banda Aceh. The sample was 168 students selected through purposive sampling technique. The technique was chosen because of certain characteristics or objectives, which is usually based on previous researchers’ knowledge of the population, namely the elements contained in the sample that are in accordance with the research objectives [11]. The main analysis used to assess the quality of instruments is CFA (Confirmatory Factor Analysis). Then, the number of samples following the minimum sample size rules of factors analysis referred to is ten times greater than the indicator used [12] where the minimum sample size for factor analysis is 100 [13,14].

The data were collected through an online questionnaire that was accessible on smartphone and laptops. There were 168 participated in the survey. Furthermore, the data were analysed using factor analysis to examine the validity and reliability.

The data obtained from the study was tested by classical assumptions through a normality test with the help of SPSS 20 software; whereas, the analysis of construct validity was carried out by using CFA with the help of Lisrel software version 8.8. The CFA used is a First order. The validity of a content can be seen from the match test interpreted from the Goodness of fit that had been determined, usually < 0.05, RMSEA value of 0.00 (<0.08), CGI, GFI, AGFI, RFI respectively> 0.90 and p-values. If the value matches the expectation, the construct is considered fit.

The goodness of fit is testing the suitability of an instrument from the observations obtained. GFI (goodness fit index) is a model suitability index as a reference to the fit assessment of a model that explains the model followed. The expected GFI value is ≥ 0.09 with the criteria of 0.00 (poor fit) to 1.00 (perfect fit) [15]. RMSEA (root mean square error of approximation) explains the residue contained in the model. The expected RMSEA value ≤ 0.05. The RMSEA value (≤ 0.05) indicates a close fit while if the value is 0.05 < RMSEA ≤ 0.08 it means that the value can be considered as a fit model (good fit) [16]. CFI (comparative fit index) is a comparative value of the model compiled with the ideal model. The expected CFI value is > 0.90. AGFI (Adjusted goodness of fit) is a GFI fit index criteria adjusted to ratio degree of freedom. The recommended AGFI value for the fit model is ≥ 0.90 [17]. NFI (numbered fit index) is a comparison of proposed models with null model. The expected NFI value is ≥ 0.90 [18].

Construct validity was analysed using convergent validity. An indicator is considered a good validity for the construct or latent variable if (a) the value of the t-load factor is greater than the critical value (t-value ≥ 1.96) [19] and (b) Standardized Factor Loading is ≥ 0.30 [13]. The reliability of the measurement model can be evaluated using composite reliability measurement or construct reliability (CR) with the reliability value categories if 0.80 < CR 1.00 means very high, 0.60 < CR
0.80 is high, 0.40 < CR 0.60 is enough, 0.20 < CR 0.40 is low, -1.00 < CR < 0.20 is very low/not reliable [20].

CR is calculated by summing the square of the standardise loading for each construct divided by the sum of squares of factor loads plus the number of error variances of a construct (Σ e_j) [21].

\[ CR = \frac{(\sum \text{Standardise Loading})^2}{(\sum \text{Standardise Loading})^2 + \sum e_j} \] [21]

3. Results and discussions
The revised instrument consisted of 28 items (Figure 1). The instrument was analysed using explanatory factor analysis (EFA) to obtain a valid construct. The results of EFA consisted of 19 items (Figure 2) which had a good construct (communality> 0.30). Communality data that has a value above 0.30 is an acceptable limit [22].

![Figure 1 Hypothetic diagram of revised instrument before validation](image1)

![Figure 2. Hypothetic diagram of instruments after validations](image2)

The result after validation shows a shift in factors and items as well as a subtracting item from the factor. This is caused by rotated component matrix value resulting from the component matrix used.
to clarify the position of the variable on a factor [23]. The results showed that 19 items of Digital Media Literacy Instruments were eligible for further testing. It was further analysed by CFA for construct analysis using Lisrel software 8.8 version.

![Diagram of digital media literacy measurement model](image)

**Figure 3.** Model of digital media literacy measurement

The model of students’ digital media literacy instrument that has been validated with the CFA technique as a whole in a good category with valid indicator results (loading score ≥ 0.5) can be used to measure students’ literacy levels.

**Table 1.** Results of Goodness of Fit

| GOF Measure                        | Estimation Result | Degree Target of Fit     | Degree of Fit   |
|------------------------------------|-------------------|--------------------------|-----------------|
| \( P \)-value                      | 0.062             | \( P \)-value > 0.05     | Good fit        |
| Normed Chi Square (\( \chi^2 \)/df) | 1.30              | Normed \( \chi^2 \) < 2  | Good fit        |
| RMSEA (Root Mean Square Error of Approximation) | 0.043 | RMSEA ≤ 0.05 | Close fit       |
| ECVI                               |                   |                          |                 |
| - Model                            | 0.85              | A small value close to ECVI saturated | Good fit       |
| - Saturated                        | 1.09              |                          |                 |
| - Independence                     | 6.33              |                          |                 |
| AIC                                |                   | A small value close to AIC saturated | Good fit       |
| - Model                            | 142.22            |                          |                 |
| - Saturated                        | 182.00            |                          |                 |
| - Independence                     | 1111.55           |                          |                 |
| NFI (Normed Fit Index)             | 0.93              | > 0.90                   | Good fit        |
| GFI (Goodness of Fit Index)        | 0.94              | GFI > 0.8                | Good fit        |
| AGFI (Adjusted Goodness of Fit Index) | 0.90  | AGFI > 0.8               | Good fit        |
| CFI (Comparative Fit Index)        | 0.98              | > 0.90                   | Good fit        |
| Root Mean Square Residual (RMR)    | 0.026             | SRMR < 0.09              | Good fit        |
Table 1 shows *p*-value 0.062 (*p*-value ≥ 0.05), meaning the level of compatibility of the model is categorized good [21]. Normed Chi-square ($X^2$), is the ratio between Chi-square and Degree of freedom. The recommended value between the lower limit is 1.00 and upper limit is 2.00, with value of 1.30 the Normed Chi-square size is categorized good [24]. The next match size is RMSEA (Root Mean Square Error of Approximation), with a RMSEA value of 0.043 (RMSEA ≤ 0.05) indicating the level of compatibility of the model is close fit [24]. ECVI value (Expected Cross-Validation Index) a model that approaches ECVI saturated value is a good fit (good). If ECVI value approaching ECVI independence is a poor fit, this applies to AIC (Akaike Information Criterion). Digital Media Literacy instrument show EVCI model and AIC model which are closer to saturated model. Therefore, the level of compatibility of the model is quite good. RMR value (Root Mean Square Residual) is 0.026 < 0.09, then the model has a good match, and CFI value (Comparative Fit Index) > range between 0.98 has a good match [25]. Then GFI value (Goodness of Fit Index) range between 0 (Poor fit) to 1 (Perfect fit). The result show 0.94 > 0.8 is (good fit). Criteria GFI also applies to NFI (Normed Fit Index). Overall, Table 2 shows that all sizes GOF show a good match. Therefore, it can be concluded that the suitability of the whole mode is good. After getting a good fit of the model, and the overall data is good, an evaluating of the suitability of the measurement model was carried out. The evaluation was conducted by observing the validity and reliability of the measurement model [24]. The results show that all t-values of the factors of each variable or item are greater than 2 (t - value > 2). Whereas for the standard factor loading value, each variable is also greater than the minimum value (standardised factor loading > 0.3). Therefore, it can be concluded that the validity of all observed variables for the latent variable is good.

Table 2. *t*-value, Standardized Factor Loading (SFL) and Construct Reliability

| Factor Affecting The Use of Digital Media Technology | Factor | SLF* | t-value** | CR*** |
|----------------------------------------------------|--------|------|----------|-------|
| FA8                                                | 0.80   | 11.70|          |       |
| FA9                                                | 0.88   | 13.33| 0.82     |       |
| FA10                                               | 0.82   | 12.08|          |       |
| Self-assessment of computing and digital skill     |        |      |          |       |
| SR1                                                | 0.62   | 7.65 |          |       |
| SR2                                                | 0.57   | 6.96 |          |       |
| SR3                                                | 0.67   | 8.46 | 0.79     |       |
| SR4                                                | 0.62   | 7.75 |          |       |
| SR5                                                | 0.65   | 8.27 |          |       |
| DM3                                                | 0.60   | 7.54 |          |       |
| Digital Media Literacy Test                       |        |      |          |       |
| DM6                                                | 0.96   | 6.78 | 0.81     |       |
| DM9                                                | 0.67   | 5.93 |          |       |
| Question Related To The Use Of Digital Technology  |        |      |          |       |
| QR2                                                | 0.82   | 7.73 | 0.65     |       |
| QR3                                                | 0.56   | 5.91 |          |       |

*SLF ≥ 0.30, **t-value ≥1.69 *** reliability value 0.80 < CR 1.00 (very high), 0.60 < CR 0.80 (high), 0.40 < CR 0.60 (moderate), 0.20 < CR 0.40 (low), and -1.00 < CR < 0.20 (very low/not reliable)

The results of construct reliability in Table 2 show that the construct reliability of Digital Media Literacy is very high (0.80 < CR 1.00) for factors in the use of digital media technology and digital media literacy exercises. Digital and computer abilities, and the use of digital media technology shows high reliability (0.60 < CR 0.80).
4. Conclusion
The results showed that the construct validation of digital media literacy instruments for students’ teachers are good; while the value of construct reliability shows very high and high category. Thus, it is concluded that the instrument can be used to measure students’ digital media literacy levels.

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