Measuring internet addiction: adaptation and validation of the Chen Internet Addiction Scale (CIAS) on Indonesian version

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Abstract. Since its emergence in Indonesia in the early 1990s, the Internet has continued to increase its use, collaborated with smartphones, making the Internet continue to explode. However, Internet usage has become a hot issue, both at the individual and community level. Excessive and uncontrolled Internet usage creates a variety of negative impacts. In Indonesia, there is no validated assessment tool for Internet addiction. Therefore, this study validates an Indonesian translation of the Chen Internet Addiction Scale (CIAS). The sample used 213 students in Indonesia. Validation constructs, person and reliability used RASCH Model analysis. Based on the results of validity and reliability tests show that Chen Internet Addiction Scale (CIAS) meets the requirements of validity and reliability. It can thus be identified that this instrument can measure the Internet Addiction (IA).

1. Introduction

The Internet is a revolution throughout the world of technology and communication worldwide [1]–[5] including Indonesia. With the development of economy and technology, the internet is becoming popular [6], [7]. The Internet offers them a portal to distract and communicate them with profit but also risk [8]. Using the internet has been integrated into the daily life of students for learning and social purposes [9], [10], the internet is also an irreplaceable daily tool for students [11]. However, this technology also raises the problem on users [12], especially students [1]. Many research has to do with the problems with Internet users who lead to Internet addiction (IA) [13].

Internet Addiction (IA) is becoming a serious problem in public health worldwide [6]. IA can be defined as an impulse control disorder that does not involve booze [14]–[18]. Wang et al. All found that he was due to a poor relationship between a parent and adolescent, then stress [19] also acted as a causative factor of IA [20]–[23]. Other studies have found that individuals who have low self-regulation and self-efficacy are at greater risk of becoming IA [22], [23]. Hence IA is common among adolescents and is associated with negative outcomes [24], ie academic career problems, which can then impact the mental health of students [11], [25] IA significantly influenced depression and anxiety [23] which resulted in students experiencing academic failure [11], [26], [27]. IA also implications for privacy and loss of self-esteem, cyberbullying and sleep disorders [8].

Governments in some countries around the world have anticipated the increase in students who experience IA. Indonesia also needs to do the same so that the problem does not become solved. This can be done, ie...
starting by identifying students who experience IA. Chen Internet Addiction Scale (CIAS) [9], [21], [24], [28] can identify and measure IA well.

2. Method

The participant involved in this study as 213 students in Indonesia. Sample used simple random sampling. CIAS is used to measure the level of Internet addiction in students. CIAS contains 26 items using a 4-point Likert-type scale. The data analyzed used Rasch model, which is focused on estimating reliability components, principal component analysis (PCA) of standardized residual following extraction of the RASCH component, validity rating scale, item fit and item difficulty and measurement instrument information. The software WINSTEPS 4.01 was used to generate and examine CIAS. Rasch modeling is the development of Item Response Theory (IRT) which has exploded since the 1960s, in Social and Behavioral Sciences [29], [30]. The Rasch Model is considered an analytical method that has many advantages for providing aim measures, including: (1) providing a linear measure, (2) overcoming missing data[31], (3) having precise estimates, (3) finding misfits and outliers in the data, and (5) provides a measurement instrument independent of the parameters studied. The advantages mentioned are not got from the Classical Test Theory (CTT), which has been used by scientists Social and Behavioral Sciences, where the CTT is still influenced by the subject, assessment characteristics, sample size, the effect of limit and ceiling (floor-ceiling effect), and the characteristics of measuring instruments [30][31]. The research data set can be accessed in Open Science Framework [32].

3. Result and Discussion

3.1 Reliability

Three types of reliability tests performed on CIAS, among others: (1) reliability of items, (2) person reliability, and (3) reliability of interaction between items and person. Based on the reliability test known item reliability is .97 (SE of item mean = .11), for person reliability is .8 (SE of person mean = .05), and the interaction between items with the persons (Cronbach \( \alpha \)) as a whole is .87. This shows that the consistency of answers from the respondents is excellent, and the quality of the items in CIAS. The interaction between the person and the item is good.

3.2 Principal Component Analysis (PCA) of standardized residual following extraction of the RASCH component

The unidimensional of the instrument is an important measure for testing whether CIAS can measure what should be measured. In the RASCH analysis used PCA model.

| Total raw variance in observations | -- Empirical-- | Modeled |
|-----------------------------------|---------------|---------|
| 39.9                              | 100.0%        | 100.0%  |
| Raw variance explained by measures | 12.9          | 32.3%   |
| Raw variance explained by persons  | 3.8           | 9.5%    |
| Raw Variance explained by items    | 9.1           | 22.7%   |
| Raw unexplained variance (total)   | 27.0          | 67.7%   |
| Unexplained variance in 1st contrast | 3.0           | 7.5%    |
| Unexplained variance in 2nd contrast | 2.5           | 6.4%    |
| Unexplained variance in 3rd contrast | 1.8           | 4.5%    |
| Unexplained variance in 4th contrast | 1.7           | 4.3%    |
| Unexplained variance in 5th contrast | 1.6           | 4.0%    |

Standardized residual variance scree plot

Table 1 shows the raw variance data measurement is 32.3%, which means unidimensional requirements are fulfilled (> 40%). In addition, the unexplained variance of the instrument 7.5%, 6.4%, 4.5%, 4.3%, 4.0%, does not exceed the tolerance threshold of 15%. Thus, CIAS can measure the extent to which diversity is to be measured and unidimensional.
3.3 **Validity of Rating Scale**

The verification process for assumption test on rating used in CIAS uses "R" modeling, ie by seeing the increase of monotonic measurement score on observed average parameter and coherence value of answer choice provided.

In the table 2, it is known the mean observed average value moves, ie from the smallest logit value -8.4 logit to the positive +93 logit. The measurement coherence value which reflects whether the measurement is influenced by the answer category or vice versa (M→C, and C→M) shows the stability of the percentage value.

| CATEGORY | OBSERVED | OBSVD SAMPLE | INFIT | OUTFIT | COHERENCE | ESTIM |
|----------|----------|---------------|-------|--------|------------|-------|
| LABEL    | SCORE    | COUNT% AVGRE | EXPECT | MNSQ   | MNSQ M→C M→ | RMSR DIS CR |
| 1        | 1        | 847 15 -84  .84 | 1.06 | 1.15  | .79% .9% | 1.1081 | 1 |
| 2        | 2        | 2280 40 -33  -.33 | .98 | 1.00 | 52% 73% | .4936 | 1.04 | 2 |
| 3        | 3        | 1843 32 .23 | .23 | .91 | .87 | 46% 57% | .5645 | 1.14 | 3 |
| 4        | 4        | 781 14 .93 | .93 | 1.01 | 1.04 | 73% 15% | 1.1221 | .99 | 4 |

**Table 2. Summary of Category Structure Model="R"**

OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.

3.4 **Item Fit and Item Difficulty**

In the Rasch analysis, estimates of difficulty items aim to look at items that have difficult or easy levels for respondents. Analysis of 26 items in Chen Internet Addiction (CIAS) found that item number 24 (+.99 logit) was the most difficult item to be approved by all respondents. Meanwhile, item number 22 (-1.07 logit) is the easiest item to be approved by all respondents. Summary of the distribution of difficulty level felt by respondents in Chen Internet Addiction (CIAS) is presented in Table 2.

**Table 3. Constructing Examinations from Calibrated Item, Item Difficulty, and Item Fit of the Chen Internet Addiction (CIAS) (N=84, Item=31)**

| Item Number | Measure | INFIT MSNQ | OUTFIT MSNQ | Perceived Difficulty |
|-------------|---------|------------|-------------|----------------------|
| 24          | .99     | .86        | .87         | Item too Difficult   |
| 21          | .68     | 1.09       | 1.07        |                      |
| 15          | .66     | 1.24       | 1.23        |                      |
| 26          | .52     | .98        | .97         |                      |
| 18          | .48     | 1.17       | 1.18        |                      |
| 19          | .43     | 1.10       | 1.12        |                      |
| 9           | .41     | 1.10       | 1.12        |                      |
| 11          | .40     | .68        | .68         |                      |
| 2           | .34     | .90        | .89         |                      |
| 8           | .22     | .67        | .66         |                      |
| 20          | .21     | .70        | .70         |                      |
| 5           | .19     | 1.08       | 1.12        |                      |
| 12          | .18     | .72        | .72         |                      |
| 6           | .15     | .67        | .70         |                      |
| 10          | .12     | .94        | 1.05        |                      |
| 25          | .11     | .96        | .95         |                      |
| 23          | .02     | .84        | .82         |                      |
| 16          | -.03    | 1.05       | 1.15        |                      |
| 14          | -.29    | 1.30       | 1.30        |                      |
| 17          | -.42    | .66        | .66         |                      |
| 13          | -.67    | 1.54       | 2.06        |                      |
| 1           | -.77    | 1.01       | 1.08        |                      |
| 3           | -.85    | .77        | .76         |                      |
| 4           | -.88    | .87        | .86         |                      |
| 7           | -.98    | 1.48       | 1.48        |                      |
| 22          | -.1.07  | 1.57       | 1.54        |                      |

Item calibration, INFIT MSNQ, and OUTFIT MSNQ in Logit

MEAN INFIT MNSQ = 1.00, MEAN OUTFIT MNSQ = 1.03

MEAN INFIT ZSTD = -.2, MEAN OUTFIT ZSTD = 0

MEAN Item = .00, S.D. Item = .55
Table 2 also shows the estimate of the fit items by looking at whether the average sensitivity of the answer pattern (INFIT MNSQ), and the sensitivity of the difficulty level (OUTFIT MNSQ) of all persons reflects the measurement implications well. The item fit analysis in Chen Internet Addiction (CIAS) is known item number 13 and 22 have INFIT and OUTFIT MNSQ values that exceed the ideal measurement range, +0.50 logit - +1.50 logit. This shows that although it does not degrade the quality of the measurement, the five items are not good enough to be used in Chen Internet Addiction Scale (CIAS).

The result differs from the condition of 24 other items, where the INFIT and OUTFIT MNSQ values do not exceed the range of +0.50 logit - +1.50 logit. This shows that only 24 items have good conditions for measurement. The average estimate of INFIT and OUTFIT ZSTD at Chen Internet Addiction (CIAS) is -2 logit - +2 logit. This shows that the Chen Internet Addiction (CIAS) data still has logical measurement estimates.

3.5 Measurement Instrument Information
The X-axis in graph 1 shows the respondent's abilities level. The Y-axis describes the magnitude of the information function got. In the Graph 1 it is known at the low response, ability levels the measurement information got is also low. The same thing happened at the high-ability level of respondents where the measurement information presented was also high. At the level of abilities of medium responders, information got by measurement is very high. This shows that the test produces optimal information when given to respondents with moderate abilities.

4. Conclusions
Based on the above description can be concluded that the CIAS instrument meets the validity and reliability requirements of the instrument. This means that the CIAS instrument can measure the IA, and it concluded that the construct of the CIAS already created versions of Indonesia can assist in identifying conditions IA in Indonesia. The existence of this instrument is expected to identify and facilitate in recognizing IA.

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