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Development and Standardization of Adolescents' Social Anxiety Scale Using the One-Parameter Logistic Model of Item Response Theory

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ABSTRACT
The aim of the study was to develop the Adolescents' Social Anxiety Scale (ASAS) using the one-parameter logistic model of item response theory. In order to develop the scale, five research questions guided the study. Descriptive survey research design was used for the study. The instrument for data collection was the Adolescents' Social Anxiety Scale- a 55-item questionnaire with 'yes' and 'no' options developed by the researcher. The items in the instrument were subdivided into 3 subscales titled fear of negative evaluation (FNE), social avoidance and distress-new (SAD-N) and social avoidance and distress -general (SAD-G). A sample of 432 SS2 students drawn through multi-stage procedure involving stratified random sampling and cluster sampling was used. Assumptions of unidimensionality and local independence were evaluated using exploratory factor analysis. The maximum likelihood estimation procedure for one-parameter logistic model was employed for the IRT analyses, test of proportion was used for prevalence and the independent t-test was used for gender and locational differences. 33 items were selected and calibrated. The unidimensionality and local independence assumption were met. The item parameters showed that the minimum ASAS difficulty is -0.5698 and the maximum ASAS difficulty is 0.9088; the minimum ASAS ability parameter for the examinee is -2.8129 while the maximum is 2.4534. All the calibrated items fitted the model and the overall model fit was significant at p value of 0.000. The item information function was produced for all the items and the maximum test information was 3.646 at ASAS theta 0.200. One of the recommendations of the study is that ASAS should be used as part of entrance tests in schools so as to detect the presence of social anxiety and necessary remediation where applicable.
Keywords: Social anxiety, Item Response Theory, Adolescents, Scale

INTRODUCTION

Anxiety is a mental condition whose prominent feature is fear. Social anxiety is featured by intense fear of certain situations in which one is being watched or evaluated by others (Helpguide.org) and also featured by over whelming fear and excessive consciousness in social situations (Roberson-Nay, Strong, Nay, Beidel & Turner; 2007). People with social anxiety admit that they have no reason to be frightened by such situations but claim that they are helpless in avoiding it and that if they try to avoid it, they will be over shadowed by attacks. It is social anxiety that makes a student that knows the right answer to a question posed by a teacher to sit down and watch the teacher or other students to answer instead of answering the question for fear of being embarrassed or humiliated. Some even prefer to whisper the answer to fellow students instead of answering. The incidence of social anxiety disorder (SAD) appears to be very high and in spite of how high the incidence of social anxiety is, very few standardized instruments are available to measure social anxiety such as the Social Anxiety scale for Children Revised (SASC-R) by La Greca and Stone (1993), the Social Anxiety Scale for Adolescents (SAS-A) by La Greca and Lopez (1998) and the social phobia and anxiety inventory (SPAI) by Turner, Beidel, Dancu, and Stanley (1989). Researches conducted on social anxiety disorder were done using foreign instruments which could be culture-biased and some conducted using unstandardized instruments. Furthermore, most of the

instruments used for such research adopted the classical test theory (CTT) model with its serious shortcomings like test-dependent characterization of examinee and examinee dependent characterization of test items. Also, the true score in CTT is not an absolute characteristic of the test taker since it is a function of the content of the test items which are summed across items to get a score and so is not an accurate measure of an individual's ability or trait level. The IRT was developed to overcome these limitations. In IRT, item parameters are group invariance. This investigation is therefore interested in developing not only a local relevant instrument to measure social anxiety but also to use the IRT model with its advantages to detect the incidence and prevalence of social anxiety disorder (SAD) among adolescents.

The framework of item response theory (IRT) encompasses a group of models and the application of each model depends on the nature of the test items. Models can be unidimensional or multidimensional. Unidimensional models measure one construct while multidimensional models measure more than one construct. Unidimensional models are either dichotomously scored (wrong/right, yes/no) or polytomously scored (Likert scale).The item response theory of test development presupposes that in testing situations, examinee performance can be predicted or explained by defining examinee characteristics. The theory assumes that the probability of a given response is determined by both the person's ability and the item's difficulty (Douglas, Khavari, & Farber; 1979) for one-parameter logistic model.

Korashy (1995) applied the Rasch one-parameter measurement model to the selection of items for a mental ability test. The Otis Lenon mental test Advanced form J was used for the study. The test consists of 80 items, 46 verbal, 17 symbolic and 17 figural. Two hundred and sixty five students constituted the sample of the study. The MSCALE program, which uses the PROX and UNCON procedures were employed to estimate the item parameters and person ability. Results show that using the classical test model procedures may be useful in the first stage of the development and revising the items. The study concluded from its results, that the Rasch measurement model proved to be more effective in providing reliable and objective parameters of item validation and person ability estimate.

Gallini (1983) applied the one-parameter latent trait model to investigate the fit of the observed performance on the Raven progressive matrices item to what was expected of the model. The standardized Raven progressive matrices were distributed to 151 seventh grade students; equivalent to Junior secondary one students in Nigeria from an urban middle school in the South East Caroline. The latent trait analysis was conducted using the unconditional maximum likelihood procedure (UNCON) of the computer programs BICAL. Results showed that the observed proportions and those expected to correctly answer the items for the different ability groups were significant and fit the model. The conclusion was that more than one trait underlies test performance on the Raven.

Another study conducted by Roberson-Nay, Strong, Nay, Beidel and Turner (2007) developed the abbreviated version of social phobia and anxiety inventory (SPAI) using the non-parametric item response theory. Participants included a non-clinical sample of 1482 undergraduates and a clinical sample of 105 individuals diagnosed with either generalized or specific social phobia. Twenty three of the 45 SPAI items demonstrated good discrimination along the social anxiety continuum. The option characteristic curves (OCCs) indicated that the SPAI 7-point scale may generate errors in ranking individuals, thus options were collapsed to improve item performance. No gender differences emerge between any of the item's OCCs showing that items are not bias among women and men. The abbreviated version also correlated highly with the original 45 item SPAI.

Purpose of the study

The purpose of the study was to develop and standardize the adolescents' Social anxiety scale (ASAS) which is intended to be use in the measuring of the incidence and prevalence of social anxiety in adolescents. This implies that the scale will determine among others, the following:

- Estimate the item parameter-difficulty (b).
- Estimate the ability or trait parameter (Ɵ).
- Evaluate model fit,
- Item information analysis.

- Test or scale information analysis.

Research questions:

- What are the estimates of difficulty parameter?
- What are the estimates of trait parameter?
- What is the model fit of the test constructed?
- What is the item information function?
- What is the scale information function?

METHOD

The research adopted the descriptive survey research design. The population of the study comprises of all SS2 student in the 19 secondary schools in the Andoni/Opobo, Nkoro federal constituency of Nigeria whose number is 1123 students. The sample of the study was 432 SS2 students composed through multi-stage procedure. The instrument for data collection was the adolescents' social anxiety scale (ASAS) developed by the researcher. It comprises 3 subscales (A-C). The reliability and validity which are the test information and model fit for IRT respectively were established.

RESULTS

Research question 1: *What are the estimates of difficulty parameter?*

Table 1. Summary estimates of Item difficulty for all calibrated items

Parameter	Items	Mean	SD	Min	Max
B	33	0.1796	0.3691	-0.5698	0.9088

Table 1 shows the summary of difficulty parameter of all the calibrated items. There are 33 calibrated items. The difficulty (b) parameter has a mean of 0.1796 and standard deviation of 0.3691. The minimum difficulty parameter is-0.5698 while the maximum difficulty parameter is 0.9088.

Research Question 2: *What are the estimates of trait parameter?*

Table 2 Test takers' trait estimates.

Test	Examinees	Mean	SD	Skew	Min	Q1	Median	Q3	Max	IQR
Full Test	432	0	1	-0.3787	-2.8129	-0.6677	0.0883	0.6428	2.4534	1.3105

Table 2 shows summary of test takers' ability estimates on ASAS. The full test has 432 test takers with a mean of 0 and standard deviation of 1. The full test has skew of -0.3787, Q1 of -0.6677, median of 0.0883, Q3 of 0.6428, IQR of 1.3105. The maximum ASAS score is 2.4534 while the minimum ASAS score is -2.8129.

Research Question 3: *What is the model fit of the test constructed?*

Table 3a Fit statistics of the items to the model

Item ID	Option		Z residual	P
	1	0		
1	250	182	1.182	0.237
2	213	219	0.538	0.591
3	221	211	0.840	0.401
4	254	178	1.252	0.211
5	215	217	0.244	0.807
6	235	197	0.801	0.423

7	194	238	0.553	0.580
8	204	228	0.859	0.390
9	200	232	1.072	0.284
10	222	210	0.259	0.796
11	182	250	0.747	0.455
12	201	231	1.114	0.265
13	198	234	0.493	0.622
14	238	194	0.910	0.363
15	206	226	0.232	0.817
16	223	209	0.849	0.396
17	184	248	0.738	0.461
18	191	241	0.343	0.732
19	188	244	0.313	0.755
20	248	184	0.655	0.512
21	181	251	0.608	0.543
22	189	243	1.112	0.266
23	158	274	0.325	0.745
24	175	257	0.927	0.354
25	192	240	0.632	0.527
26	200	232	0.263	0.793
27	237	195	0.205	0.837
28	211	221	0.621	0.535
29	169	263	0.759	0.448
30	187	245	0.202	0.840
31	187	245	0.895	0.371
32	223	209	0.882	0.378
33	190	242	0.314	0.753

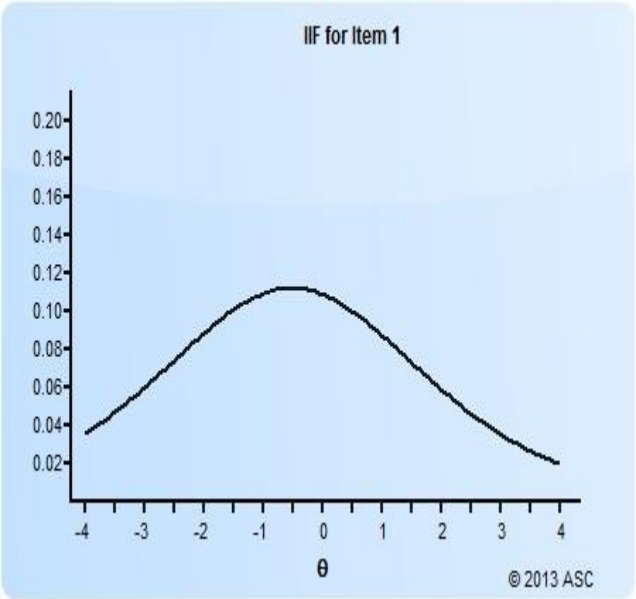
Table 3b Overall Model Fit

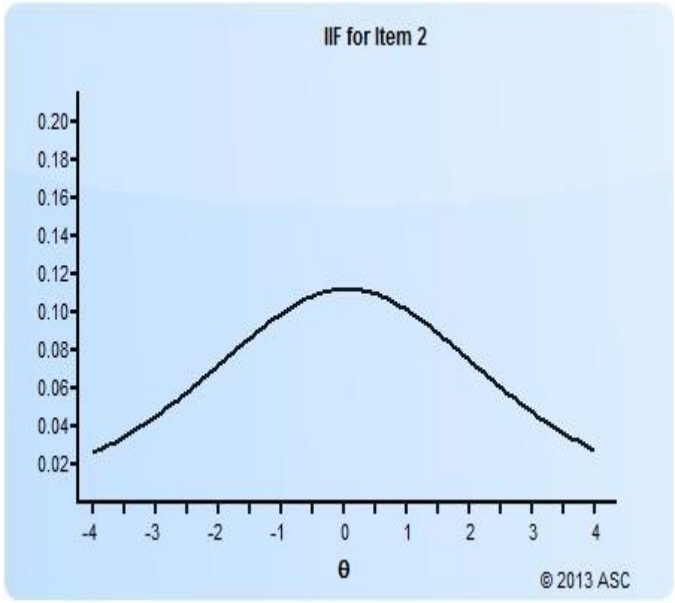
Test	Items	Chi-square	Df	P	-2LL
Full Test	33	666.5366	462	0.000	18213.81

Table 3a shows the z-residual of all calibrated items and their corresponding p-values. For instance item 1 has a z-residual of 1.182 at p-value of 0.237. All calibrated items have z-residuals with p-values greater than 0.05. Therefore all the calibrated items fit the model. Table 3b shows the overall model fit of the test. The full test has 33 calibrated items with chi-square of 666.5366, degree of freedom of 462 at p-value of 0.000 which is less than the significant level of 0.05 and is therefore significant and implies that the full test fit the one parameter logistic model.

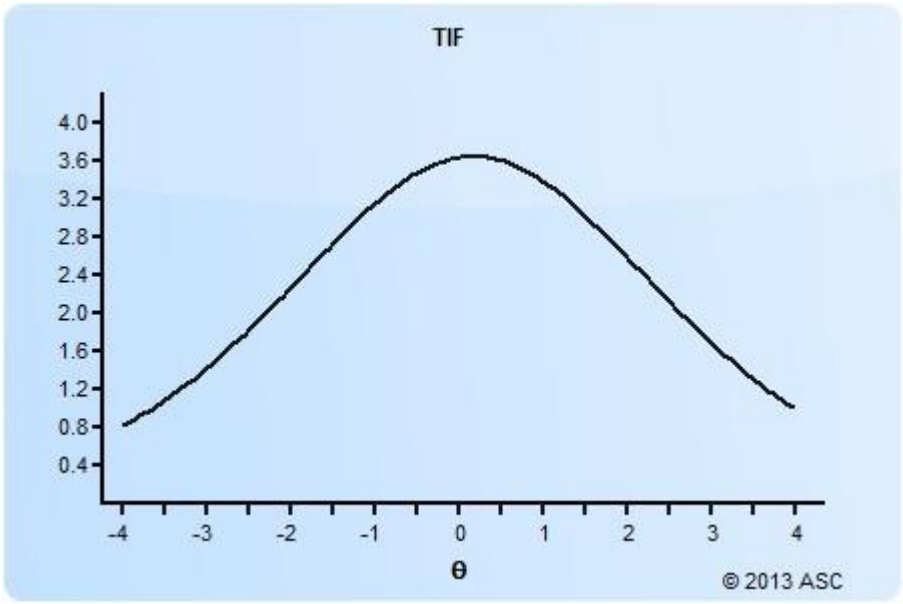
Research Question 4: *What is the item information function?*

Figure 1 displays a graph of the item information function for item 1 and 2. The item information function is the graphical representation of how much information the item is providing at each level of theta. The sum of all the IIF of the calibrated items is the TIF. Maximum information on each of the calibrated items is displayed. Maximum information on item 1 was 0.1121 at theta levels -0.45, -0.5 and -0.55. The maximum information on item 2 was 0.1121 at theta levels 0, 0.05 and 0.1.





Research Question 5: *What is the scale information function of the test constructed?*
Figure 2 displays a graph of the Test information function (TIF) and the graph of the conditional standard error of measurement (CSEM) for all calibrated items. The TIF is a graph that represents how much information the test is providing at each level of ASAS theta. Maximum information was 3.646 at ASAS theta 0.200 while the CSEM is an inverted function of TIF. The CSEM estimates the amount of error in ASAS theta estimation for each level of ASAS theta. The minimum CSEM was 0.524 at ASAS theta 0.200. Therefore the scale information function is 3.646 at theta 0.200.



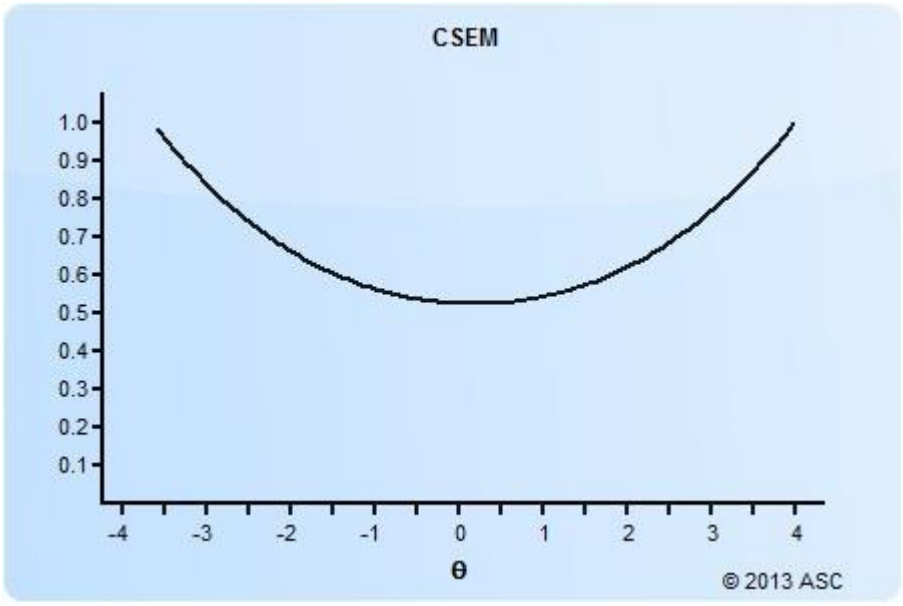


Fig. 2 Test information function (TIF) and conditional standard error of measurement (CSEM) for all calibrated items.

DISCUSSION OF RESULTS

The estimates of item difficulty for each of the calibrated items in the test constructed were produced. There are 33 calibrated items. The minimum difficulty parameter is -0.5698 while the maximum difficulty parameter is 0.9088.

The estimates of ability parameter were also produced. Four hundred and thirty two (432) examinees' ability parameters were estimated with the calibrated 33 items. The examinees with the maximum ASAS score is 2.4534 while examinees with the minimum ASAS score is -2.8129.

The fit of the test items to the model indicate that all calibrated items fitted the model since the items have z-residual whose p-values are greater than the significant level (0.05). The full test also fitted the model at p-value of 0.000. The fit of the items to the model replaces CTT's validity.

The item information functions (IIF) were also produced. It is the graphical representation of how much information the item is providing at each level of ASAS theta (trait). The sum of IIF of the calibrated items is the test information function (TIF). Maximum information on each of the items was also provided for instance, maximum information on item 1 was 0.1121 at ASAS theta (trait) levels -0.45, -0.5 and -0.55. The TIF was also produced. Maximum TIF is 3.646 at ASAS theta 0.200. In IRT, the TIF replaces CTT's reliability.

RECOMMENDATIONS

From the findings of this study, the following recommendations were made:

- The ASAS should be used by teachers, researchers, counselors, social workers etc to measure adolescents' social anxiety.
- ASAS should be used as part of entrance test in schools so as to detect the presence or absence of social anxiety among prospective students and further commence treatment early enough where applicable.

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