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Validating Academic Integrity Survey (AIS): An Application of Exploratory and Confirmatory Factor Analytic Procedures

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Abstract This study concerned validating academic integrity survey (AIS), a measure developed in 2010 to investigate academic integrity practices in a Malaysian university. It also examined the usefulness of the measure across gender and nationality of the participants (undergraduates of Nigerian and Malaysian public universities). The sample size comprised 450 students selected via quota sampling technique. The findings supported the multidimensionality of academic dishonesty. Also, strong evidence of convergent and discriminant validity, and construct reliability were generated for the revised AIS. The testing of moderating effects yielded two outcomes. While the gender invariant analysis produced evidence that the three-dimensional model was not moderated by gender; the nationality effect was inconclusive, probably due to a noticeable imbalance in respondent distribution for the nationality group. The significance of this study lies not only in the rigorous statistical methods deployed to validate the dimension and psychometric properties of the AIS; but establishing the gender invariance of the model. It is understood from the findings that although male and female students may vary in their academic misconducts, the underlying factors for these conducts are the same and can be addressed effectively using a non-discriminating approach.

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Introduction

The necessity of a well validated measure, in social/behavioral research, can not be over-emphasized. Research have shown that a good instrument should measure accurately and consistently what it purports to measure (Fields 2002; Creswell 2008; Hair et al. 2010). According to Colton and Covert (2007), when an instrument fails in the above onerous task, its result raises doubts. Constant validation and evaluation of measures is a key to guarantee that behavioral construct(s) are defined and measured appropriately (Hair et al. 2010). For this reason, Hair et al. strongly recommended that researchers should always confirm the validity and unidimensionality of their constructs even if well-established scales are involved. According to Creswell (2008), reliability and validity are strong issues in a credible measure of psychological constructs, crucial to effectiveness of any research instrument.

Although, academic dishonesty is a phenomenon well reported in the literature (Lim and See 2001), much is left undone about psychometric properties of most previous measures. As a result, findings/conclusions of those studies are treated with cautions. Besides, literature is characterized by inconsistencies of the dimension of academic dishonesty. Consequently, there are several published studies but a little shared understanding of meaning and common variables constituting academic dishonesty. This further contributes to high discrepancies in the results for prevalence of academic dishonesty (Nelson and Shaefer 1986; Karlins et al. 1988). What follows is a brief review of the extant literature on measures and dimensionality of academic dishonesty.

Previous Measures of Academic Dishonesty

It is pertinent from the literature that several measures have been developed to investigate academic dishonesty. However, as Imran and Sahari (2013) pointed out, most of the measures lacked evidence of sound psychometric properties and their dimensionalities were not painstakingly investigated. Few examples would suffice to buttress this point.

One of the measures frequently used to investigate academic dishonesty was the scale developed by McCabe and Trevino 1993. The scale measured students' self reported academic dishonesty with 12 items, on a 5-point scale ranging from 1 (= never) to 5 (= many times). This scale has been employed in several studies including McCabe and Trevino (1997). Despite its wider application in the literature, the psychometric properties have not been critically investigated. Apart from a token of information on internal consistency (Cronbach's alpha =0.794), no additional information on validation was provided (either through the exploratory factor analysis and/or confirmatory factor analysis).

Notwithstanding its deficiency, Iyer and Eastman (2006) adapted the McCabe and Trevino's (1993) measure. The adapted items were said to be similar with those in Brown's (1996; 2000) and Kidwell et al. (2003) studies. Like in McCabe and Trevino, a 5-point scale ranging from 1 (= never) to 5 (= many times) was used. Although it was claimed that Multitraits-Multimethods (MTMM) analysis was used to establish convergent and discriminant validity of the scale, there was no concrete evidence regarding this analysis.

Also, Lim and See (2001), in a study on attitudes and intentions toward reporting academic cheating among students in Singapore, used a 21-item measure adapted from Newstead et al. (1996). Data were collected on a 5-point scale ranging from 1 = never, to 5 = frequently. The 21-item scale yielded Cronbach's alpha 0.86 for self-reported cheating, and 0.90 for perceived seriousness of cheating. However, like the other measures discussed, no further information was given concerning the validity and factor structure of the scale's items.

Interestingly, even some recent studies too use measures with less sound psychometric properties. For instance, in Bates et al. (2005) '*Students today, pharmacists tomorrow: A survey of student ethics*,' the current validity and reliability, and scale dimensionality of the 12 scenarios adapted were not mentioned. The same was the case with Arhin (2009) who adapted the twelve items used in Bates et al. (2005). The author only highlighted that clarity and face validity of the items were checked through focus groups and pilot study but no concrete evidence of the reliability and factor structure of the items.

Similarly, the case of thirteen unethical conducts used in Nazir et al. (2011) were not different from the other measures discussed above. The measure lacked detailed psychometric properties. The authors barely listed the internal consistency (0.85) but no further information on validity and factor structure of the items.

Besides validation/estimation of psychometric properties, literature is also characterized by inconsistent findings about dimensionality of academic dishonesty. This issue is examined in the next paragraphs.

Dimensionality of Academic Dishonesty

Just as the definition of academic dishonesty is laced with controversies among scholars, so is its dimensionality. While some researchers viewed the phenomenon as a multi-dimensional constructs with four components/factors (Dawkins 2004; Iyer and Eastman 2006; Imran 2010), others argued that it is a two-dimensional construct (Roig and DeTommaso 1995; Ferrari 2005). Yet it was viewed as unidimensional by other scholars (Pavela 1978; Rawwas and Isakson 2000). Few of those inconsistencies are briefly examined in the following paragraphs.

The four dimensions of academic dishonesty, according to Iyer and Eastman (2006), were listed as: (i) Cheating (made up of five items), (ii) Seeking Outside Help (made up of five items), (iii) Plagiarism (made up of five items), and (iv) Electronic Cheating (made up of two items); with alpha coefficients ranging from .70 to .85. Dawkins (2004) concurred with the four dimensions, although his analysis was a mere replica of items highlighted to measure cheating by other studies. These dimensions included: Cheating on classroom tests; copying from the internet; knowledge and awareness of others' (peers) cheating; and lying to avoid detection.

Nonetheless, researchers like Roig and DeTommaso (1995), and Ferrari (2005) opined that academic dishonesty is a two-dimensional construct namely, 'plagiarism' (regarding written home works) and 'cheating' (regarding class tests and exams). For Rawwas and Isakson (2000), academic dishonesty is a unidimensional construct comprising four general items listed as: 'Aiding and abetting dishonesty conducts; obtaining an unfair advantage; fabricating information; and ignoring prevalent practices'.

The dimension reported by Pavela (1978) was in accord with Rawwas and Isakson, one-dimensional with four items. She identified those items as: Using unauthorized materials for academic activity (i.e. assignment and class test); fabricating information, references, or results; plagiarizing; and helping other students in academic dishonesty (i.e. facilitating academic dishonesty).

The above notwithstanding, a case was made for measuring academic dishonesty under a specific form or dimension rather than using general items. According to Swift and Nonis (1998), when students were asked about cheating in the general sense, only 60 % of the students admitted to have cheated at least once, but when the summated score for all specific forms of cheating were totaled, about 87 % of the students admitted cheating at least once. Thus, identifying specific cheating behaviors may reveal academic dishonesty better than using general questions (Swift and Nonis 1998).

Therefore, the ultimate goal of this study is in twofold: Validating the psychometric properties of the refined academic integrity survey (AIS); and determining its dimensionality. The study also aims to test the moderating effect of gender and nationality on the revised measure. The following research hypotheses are proposed to guide the thrust of this study.

1. 'AIS' is a multidimensional construct.
2. The revised 'AIS' is a valid and reliable measure of academic dishonesty.
3. The revised 'AIS' is *configural* invariant across gender and nationality of the respondents.

Methods

Sample

This study drew participants from Nigerian and Malaysian public universities. Altogether, a total of 450 undergraduates participated. A quota sampling technique was applied in the selection of participants. Quota sampling is a sampling technique in which the researcher first identify the general categories for which cases or people will be selected, and then select to reach a pre-determined number of cases in each category (Neuman 2006). This technique is most suitable in the context where the researcher is unable to get access to the comprehensive list of the participant's sampling frame as was the case in this study. Given that the undergraduates in Nigeria is almost twice of their Malaysian counterparts, a greater number of respondents were chosen from the former. This includes 280 students from Nigeria and 170 students from Malaysia. Table 1 shows the distribution of respondents and the usable responses from the survey.

Instrument

This study adapted a measure of academic integrity developed by Imran (2010). The measure, 'Academic Integrity Survey' – (AIS), was used to collect data on perceptions of postgraduate students towards academic integrity practices in a Malaysian university. AIS comprised 16 items derived from measures of previous studies such as McCabe and Trevino (1993, 1997), Lim and See (2001), Dawkins (2004), and Brown and Weible (2006).

The survey comprised a 5-point Likert scale, from 1 (not dishonesty) to 5 (serious dishonesty). High score on the scale denotes a higher perception of academic integrity practices among students. Reverse is the case for a low score. The internal consistency for the whole items was high (.946). Besides, the confirmatory factor analytic (CFA) procedure was used to establish the construct validity, resulting in a four-factor solution.

AIS was adapted because: (1) the instrument captured well key object of the present study (the academic dishonest conducts among students of higher education), and (2) the instrument was developed among students of diverse cultural and demographic characteristics; and consisted of items which have been widely used by prominent researchers in the field. Nonetheless, since most items' wordings were modified to be more suitable in the context of the present study; it was necessary to revalidate the psychometric properties as well as dimensionality of scale's items. Specifically, the wordings that referred mainly to postgraduates of the Malaysian university were amended to reflect a general use. Besides, the present study extended the response scale from 5 options to 8 options (1 = 'very strongly disagree'; 8 = 'very strongly agree'), to enable a wider variation in the participants' responses.

Validity and Reliability of Measure

Reliability of items was determined using Cronbach's alpha statistics as suggested by scholars in applied research (Field 2005; Pallant 2007; Tabachnick and Fidell 2007; Hair et al. 2010). For evidence of convergent and discriminant validity (construct validity), three statistical measures recommended by Hair et al. (2010) were applied. These include: Adequate standardized factor loadings (SFL), average variance extracted (AVE), and composite reliability (CR). SFL is the correlation between each observed variable (indicator) and the underlying latent construct which it measures. AVE is a measure of convergence among a set of items specified to measure a latent construct. It is calculated by computing an average percentage of variance explained among the items of a construct (Hair et al. 2010, p.660). Details of the mathematical formula and the output generated are included in the Appendix. The third measure, composite reliability (CR), denotes a measure of reliability and internal consistency of the items that represent a latent variable in SEM. These procedures were executed using the principal component analytic method (PCA) on the SPSS device, Version 17.0; and confirmatory factor analytic approach (CFA) via Amos statistical software.

Table 1 Frequency of respondents and usable responses

			Sample size		Usable response	
S/No	Demographic	Groups	$N = 450$	(%)	$N = 328$	(%)
1.	Gender	Male	200	44.4	148	45.1
		Female	250	55.6	180	54.9
		Total	450	100	328	100
2.	University	UKM	170	37.8	128	39.0
		OAU	180	40.0	160	48.8
		Unilorin	100	22.2	40	12.2
		Total	450	100	328	100
3.	Age	16 – 20 years	160	35.6	126	38.4
		21 – 25 years	230	51.1	160	51.2
		26 years +	60	13.3	34	10.4
		Total	450	100	328	100
4.	Marital status	Single	430	95.6	315	96.0
		Married	20	4.4	13	4.0
		Total	450	100	328	100
5.	Faculty	Engineering	40	8.9	28	8.5
		Social science	90	20.0	61	18.6
		Law	30	6.7	13	4.0
		Business	30	6.7	22	6.7
		Education	30	6.7	20	6.1
		Science	150	33.3	119	36.3
		Others	80	17.8	65	19.8
		Total	450	100	328	100
6.	Year(S) of study	1st year	90	20.0	67	20.4
		2nd year	170	37.8	120	36.6
		3rd year	95	21.1	77	23.5
		4th year	70	15.6	52	15.9
		5th year	15	3.3	11	3.4
		others	10	2.2	01	0.3
		total	450	100	328	100
7.	CGPA	0–1	25	5.6	12	3.7
		1.1–2	20	4.4	10	3.0
		2.1–3	100	22.2	67	20.4
		3.1–4	250	55.6	203	61.9
		4.1–5	55	12.2	36	11.0
		Total	450	100	328	100
8.	Country	Malaysia	170	37.8	128	39.0
		Nigeria	280	62.2	200	61.0
		Total	450	100	328	100

Data Collection/Analysis Procedure

Data were collected from undergraduates in different specializations and years of study. The participants were requested to keep a gap from their colleagues as they respond to the survey, to reduce the potential response bias. Some of the returned responses did not have a complete information, whereas only those with complete information (n = 328) were considered usable for the study. No inducement of any kind or incentive was given to the respondents, but strong assurance was made about confidentiality of responses and the fact that the data were meant for research purpose only. Besides, responses were collected using an anonymous approach. That is, respondents were not asked to provide any personal information such as, name, and matriculation number.

Thereafter, the data were keyed-in in the computer using SPSS version 17.0, screened and verified against unwarranted errors and outliers via the Descriptive statistic approach of the SPSS. This is followed by construct validity and full scale reliability tests for all items of the instrument. Before this time, a pilot test was conducted using 121 undergraduates selected from a Malaysian university (not the site of this study), to gain feedbacks on wordings and clarity of the items, as well as the specified instructions.

The Cronbach's alpha statistics showed that the measure has a high internal consistency (.916). Furthermore, the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA) techniques were applied to determine the dimensionality and evidence of convergent and discriminant validity of the measure. Tables 2, 3, 4, and 5 present results of the EFA data analysis.

It is evident in Tables 2, 3, 4, and 5 that the 16 items of the revised AIS altogether yielded a reasonable three-factor solution, using the varimax rotation (an orthogonal rotation method). This rotation method was used because Field (2005, p.670) cautioned that an oblique rotation should be used only if there are cogent reasons to suggest that the underlying factors could be related in theoretical terms. The *eigenvalue*, the scree plot and the parallel analysis techniques of factor extraction, all supported the retention of three factors. The three factors were named: "Cheating," "research misconduct" and "plagiarism," using item with highest factor loading (as suggested by Pallant 2007). There were no serious cross-loadings and only two items were dropped from the final analysis due to their low loadings. The eigenvalue of the first factor (cheating) was 7.31, consisting of 7 items, and it explained 48.7 % variance in students' academic dishonesty. The second and the third factors had *eigenvalues* of 3.06 and 1.48, comprising 4 and 3 items, and explained 20.4 % and 9.8 % variances, respectively. Altogether, the three components accounted for 78.9 % variance of the total variability in academic dishonesty.

Upon determining dimensionality of AIS measure, CFA was further used to validate the three-factor solution obtained. CFA is an indispensable statistical analytic tool for construct validation. According to Hair et al. (2010), it is the most direct method to validate the results of an exploratory factor analysis. Thus, the three factors obtained from the EFA with their respective items were sketched into a first-order measurement model, and analyzed using Amos statistical software. In line with the guidelines for interpreting goodness of fit (GoF) statistics (Browne and Cudeck 1993; MacCallum et al. 1996; Kline 2005; Hair et al. 2010), which include: a Normed Chi-square (χ^2/df)

Table 2 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.310	48.735	48.735	7.310	48.735	48.735	6.044	40.296	40.296
2	3.056	20.376	69.111	3.056	20.376	69.111	3.332	22.216	62.512
3	1.475	9.831	78.942	1.475	9.831	78.942	2.465	16.430	78.942
4	.502	3.348	82.291						
5	.385	2.569	84.860						
6	.333	2.220	87.079						
7	.303	2.020	89.099						
8	.282	1.880	90.979						
9	.268	1.786	92.764						
10	.227	1.516	94.281						
11	.213	1.419	95.699						
12	.193	1.290	96.989						
13	.187	1.250	98.239						
14	.138	.922	99.161						
15	.126	.839	100.00						

Extraction Method: Principal Component Analysis

Table 3 Unrotated component matrix

Items	Components		
	1	2	3
Use unauthorized instruments (e.g. mobile phone, crib note, etc.) in a class test or exam.	.884		
Copy other students' works without their consent in a class test/exam.	.873		
Tell a lie to receive an undeserved grade from the instructor.	.851		
Use notes during a closed book examination.	.833		
Submit other students' works as your own to obtain grades.	.832		
Employ an expert to write your assignment(s).	.817		
Copy other students' works with their permission during a class test/exam.	.816		
Fail to contribute a fair share to a group project or assignment.	.794		
Falsify list of references in a group or individual assignment.	.638		.592
Ignore the established instructions for completing an assignment or a project		.829	
Submit a previously graded assignment to another instructor for grade without changes.		.825	
Falsify lab results.		.816	
Fabricate research data.	.413	.798	
Fail to acknowledge previous studies used in the literature review.	.610		.660
Fail to acknowledge team members in a group work.	.601		.657

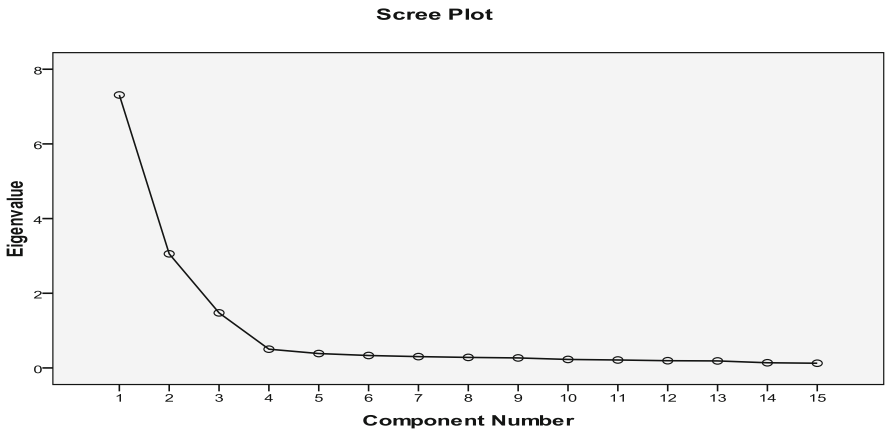
Extraction Method: Principal Component Analysis

a. 3 components extracted

Table 4 Rotated component matrix and scree plot

	Component		
	1	2	3
Copy other students' works without their consent in a class test/exam.	.901		
Use notes during a closed book examination.	.863		
Use unauthorized instruments (e.g. mobile phone, crib note, etc.) in a class test or exam.	.859		
Tell a lie to receive an undeserved grade from the instructor.	.850		
Submit other students' works as your own to obtain grades.	.849		
Fail to contribute a fair share to a group project or assignment.	.843		
Copy other students' works with their permission during a class test/exam.	.837		
Employ an expert to write your assignment(s).	.802		
Ignore the established instructions for completing an assignment or a project		.918	
Submit a previously graded assignment to another instructor for grade without changes.		.899	
Falsify lab results.		.894	
Fabricate research data.		.879	
Fail to acknowledge previous studies used in the literature review.			.855
Fail to acknowledge team members in a group work.			.854
Falsify list of references in a group or individual assignment.			.806
***Cronbach's Alpha:**			
Comp. 1: Cheating (5 Items) = *.956*			
Comp. 2: Research Misconduct (4 Items) = *.928*			
Comp. 3: Plagiarism (3 Items) = *.871*			
Overall Alpha: (15 Items) = *.916*			

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 4 iterations



The Scree Plot

value between 2.0 and 5.0 as acceptable fit; a Comparative Fit Index (CFI) value greater than 0.90 but not reaching 1.0 as indication of a reasonable good fit; and a Root Mean Square Error of Approximation (RMSEA) value between 0.05 and 0.08

Table 5 Component correlation matrix

Component	1	2	3
1	1.000	.195	.504
2	.195	1.000	.271
3	.504	.271	1.000

Extraction Method: Principal Component Analysis

Rotation Method: Oblimin with Kaiser Normalization

suggesting a moderate fit; the results of the present analysis especially, the χ^2/df (3.02), the CFI (.959), and the RMSEA (.078) showed that the model was modestly fit to the sample data of this study. This was further supported by the parameter loadings which were all quite adequate and reasonable; and correlations among factors which were all moderate (ranging from .21 to .56). There was no offending estimate and the loadings were statistically significant. Figure 1 presents output of the First-Order AIS model.

A further assessment of The model output further revealed that all the parameter loadings were high and practically reasonable (0.8 and above), suggesting the possibility of a common latent variable underlying the three factors. This requires testing a second-order CFA model to explore the underlying, central variable. Figure 2 displays the output of the tested second-order measurement model.

The output in Fig. 2 showed that the model did not lack fitting to the sample data. The results of the key GoF statistics (χ^2/df, 2.53; CFI, .971; and RMSEA, .068), were more adequate than the previous first-order model. The parameter loadings were

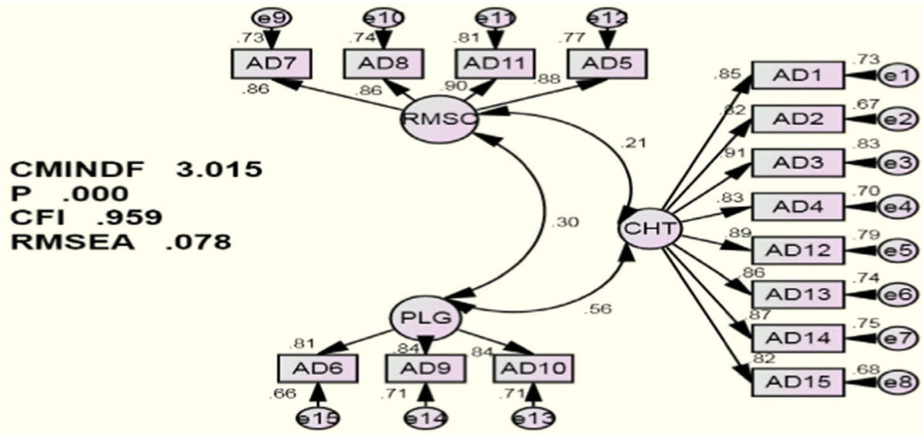


Fig. 1 First-Order AIS. CHT – Cheating; RMSC – Research Misconduct; PLG – Plagiarism; AD1 - AD15 = Item 1–15 for Academic Dishonesty; e1 – e15 = Error terms associated with AD1 – AD15; CMINDF – Relative Chi-Square; *p* – P-value; CFI – Comparative Fit Index; and RMSEA – Root Mean Square Error of Approximation

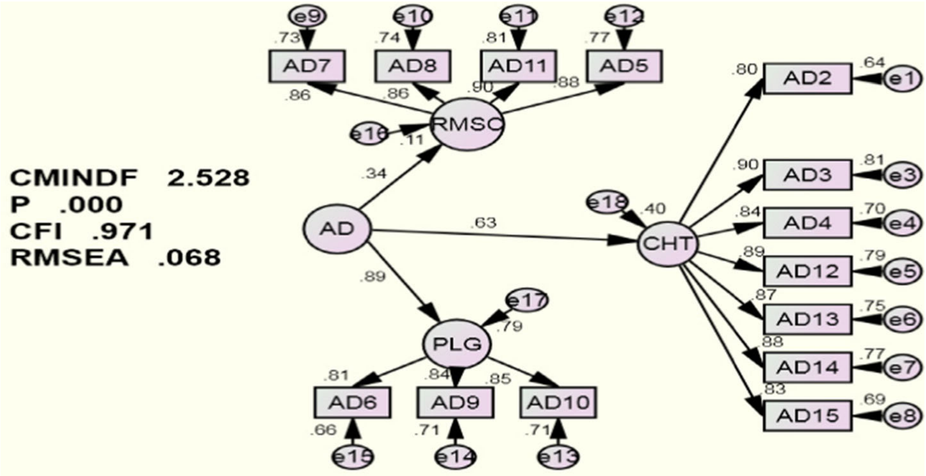


Fig. 2 Second-Order AIS. CHT – Cheating; RMSC – Research Misconduct; PLG – Plagiarism; AD1 - AD15 = Item 1–15 for Academic Dishonesty; e1 – e18 = Error terms associated with AD1 – AD15 and the three 1st order latent factors; CMINDF – Relative Chi-Square; *p* – P-value; CFI – Comparative Fit Index; and RMSEA – Root Mean Square Error of Approximation

adequate and reasonable (all loadings were above 0.5 cut-off recommended by Hair et al. 2010); and the effect sizes of the three factors were quite substantial (ranging from 34 % - RMSC, to 89 % - PLG). Besides, the three components explained a substantial, statistically significant per cent in underlying total variability in students' academic dishonesty. These include 11 %, 40 %, and 79 % for research misconduct, cheating and plagiarism, respectively. Table 6 presents the standardized regression weights for all the variables in the model.

Evidence of Convergent and Discriminant Validity

In order to establish proofs of validity and reliability of the revised AIS measure, the three statistical measures recommended by Hair et al. (2010) were applied. These included adequate standardized factor loadings (preferably loadings with 0.5 and above); the AVE values greater than 0.5 (for evidence of convergent validity), and shared values among variables (SV) lesser than their corresponding AVE values (for evidence of discriminant validity); and CR values greater than 0.7 (for evidence of construct reliability). The outcomes, as shown in Table 7, showed that the 3-dimensional AIS model was high in internal consistency; and validity of scale's dimensionalities was adequately supported. It was evident that all the AVE values were greater than the recommended threshold point (0.5), a proof of convergent validity. Also, all the AVE values obtained were greater than the SVs, denoting evidence of discriminant validity among dimensions of the measure. Lastly, the CR values were equally greater than the recommended cut-off point (0.7), pointing to proof of scale's reliability.

Table 6 Standardized regression weights

			Estimate	S.E.	C.R.	P	Label
F3	<—	AD	2.438	.662	3.683	***	par_12
F2	<—	AD	1.000				
F1	<—	AD	1.680	.366	4.597	***	par_13
AD2	<—	F1	1.000				
AD3	<—	F1	1.055	.054	19.585	***	par_1
AD4	<—	F1	1.012	.058	17.596	***	par_2
AD12	<—	F1	1.101	.057	19.284	***	par_3
AD13	<—	F1	1.020	.055	18.526	***	par_4
AD14	<—	F1	1.086	.057	18.921	***	par_5
AD15	<—	F1	1.008	.058	17.495	***	par_6
AD7	<—	F2	1.000				
AD8	<—	F2	.969	.048	20.078	***	par_7
AD11	<—	F2	1.072	.049	21.848	***	par_8
AD5	<—	F2	1.012	.048	20.891	***	par_9
AD10	<—	F3	1.000				
AD9	<—	F3	1.040	.062	16.885	***	par_10
AD6	<—	F3	.985	.061	16.271	***	par_11

S.E. – Standardized Estimates; C.R. – Critical Ratio; *p* – Power statistics; '***' = Significant at .0001 alpha level; F3 – Factor 3 (Plagiarism); F2 – Factor 2 (Cheating); F1 – Factor 1 (Research Misconduct); AD1 - AD15 = Item 1–15 adapted for Academic Dishonesty

Results for the Hypotheses

The findings for the first hypothesis (Table 4, Figs. 1 and 2), showed that the revised AIS' measure is a multi-dimensional construct, with three dimensions (i.e., cheating, plagiarism and research misconduct). These dimensions consist of seven, three and four items, respectively.

The results for second hypothesis (Table 7) provide strong evidence that the revised AIS is statistically valid and reliable. That is, evidence that different approaches to measure a conceptually distinct latent construct produce not only similar results (convergent validity),

Table 7 Average variance extracted, shared variance and composite reliability

COMPONENTS	PLG	RMSC	CHT	**CR**
Plagiarism (PLG)	**0.70**	.073	.25	**.88**
Research Misc. (R/MSC)	.27	**0.81**	.04	**.94**
Cheating (CHT).	.50	.20	**0.72**	**.95**

Diagonals (in bold and red color) represent AVEs the off diagonals (below) represent correlations among constructs, and the ones above represent the corresponding shared variance among components. Composite reliability values are presented in the last column (in bold and purple color)

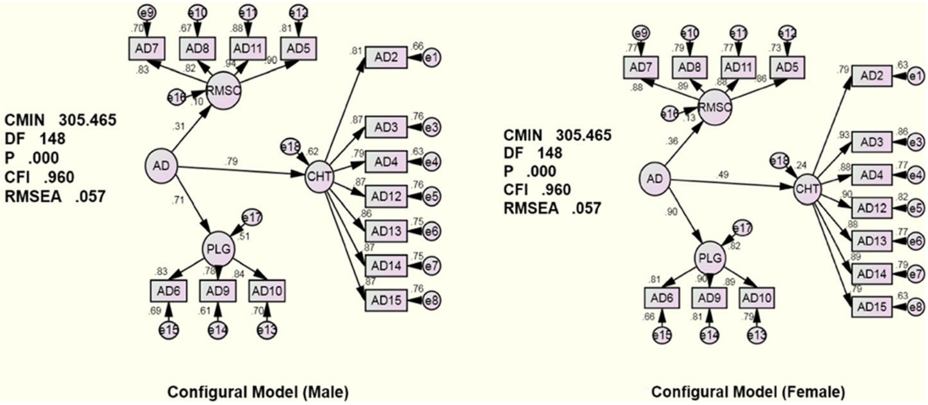


Fig. 3 Configural Model (Male, Female)

but each construct is unique and captures some phenomena which other constructs do not (discriminant validity); and that the latent constructs exhibit some degree of internal consistency in their measures (construct reliability) (Hair et al. 2010).

The outcomes of the, *configural* invariance analyses (the third hypothesis) showed that the revised AIS model is not gender bias. *Configural* is a terminology mostly used in literature to represent the model which incorporates the baseline models for two groups within the same file (Byrne 2010). It is a model which the subsequent invariant models e.g. constrained model are compared (Hair et al. 2010). Figures 3 and 4 presents the outputs for *configural* and constrained models. Only gender invariant analysis' results are displayed for discussion, the nationality group did not produce a significant outcome, probably due to a noticeable difference in sample size distribution. For instance, the usable data gathered from the

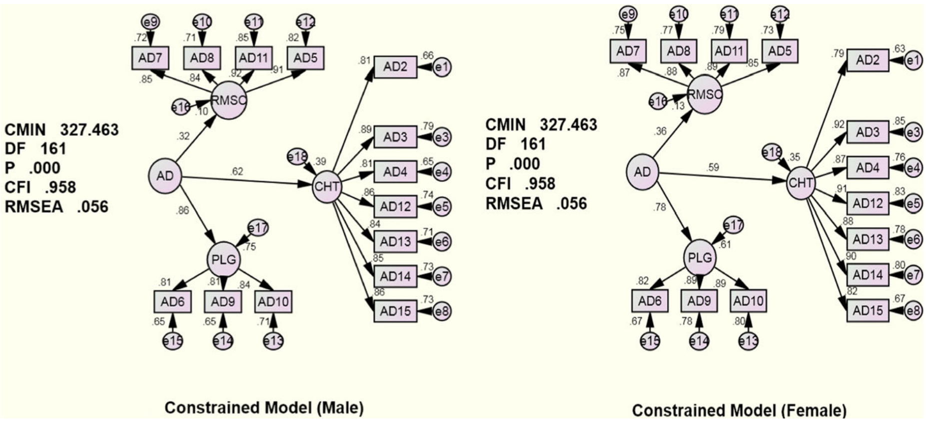


Fig. 4 Constrained Model (Male, Female). CHT – Cheating; RMSC – Research Misconduct; PLG – Plagiarism; AD1 - AD15 = Item 1–15 for Academic Dishonesty; e1 – e18 = Error terms associated with AD1 – AD15 and the three 1st order latent factors; CMIN – Chi-Square; DF – Degree of Freedom; *p* – P-value; CFI – Comparative Fit Index; and RMSEA – Root Mean Square Error of Approximation

Nigerian respondents (n = 200) were apparently greater than the ones from the Malaysian participants (n = 128). Thus, the findings regarding the nationality effect were inconclusive.

Interpreting the Gender-Invariant Analysis

The techniques proposed by prominent scholars in the field (chi-square statistic and comparative fit index "CFI") were employed to interprete results for the invariant analysis. In using the chi-square's approach, evidence of invariance is claimed if the difference in the chi-square values (between the *configural* and constrained models) with difference in their degree of freedoms is observed to be insignificant when compared with the tabulated chi-square value at a preferred, stringent alpha level (Byrne 2010; Hair et al. 2010). It should be noted that this approach has been criticized mostly by scholars in the applied research, for representing an excessively stringent test of invariance, one which might not work well with the understanding that the SEM models are at best only approximation of reality (Cudeck and Browne 1983; and MacCallum et al. 1992; cited in Byrne 2010).

A more recent, alternative approach to interpret invariant analysis was proposed by Cheung and Rensvold (2002, cited in Byrne 2010). This approach asserted that evidence of invariance analysis should be based on the difference in the CFI values (between the *configural* and constrained models) that exhibits a probability greater than 0.01. Byrne (2010) noted that though the later approach is the recent and more practical approach to testing for invariance, it has not been granted the official SEM stamp to date. Nevertheless, its use is frequently reported in the literature largely because it makes more practical sense to do so (Byrne 2010).

Following the above criteria, the results summarized on Table 8 showed that the chi-square statistics, the differences in CFI, and RMSEA's values, all argued for equivalence (invariance) of the three-dimensional AIS model across the gender of the respondents.

Specifically, the invariance test for the male (n1 = 148) and female (n2 = 180) groups resulted in a statistically insignificant change in the Chi-square value, $\Delta\chi^2$ (13) = 22.0, $p > .005$; and insignificant change in CFI and RMSEA values (ΔCFI = .002; ΔRMSEA = .001). Simply put, the difference in the Chi-square values between the *configural* and constrained models did not produce a poorer fit model. Meaning, the parameter estimates do not vary significantly across respondents' gender group. Hence, gender does not interact with the overall factors/dimensions underlying students' academic dishonesty. Better still, gender is not a moderating variable. Table 8 presents the summary of invariance analysis' results.

Table 8 Summary of invariance analysis for gender variable

Fit Statistics	*Configural* Model	Constrained Model	Difference	Tab. χ^2 (at p = 0.01)	Decision
χ^2	305.5	327.5	22.0	27.7	Not Sig.
Df	148	161	13	-	-
CFI	.960	.958	.002	-	Not Sig.
RMSEA	.057	.056	.001	-	Not Sig.

χ^2 = Chi-Square statistics; Tab.χ^2 = Table χ^2; DF = Degree of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; p = Power statistics; and Not Sig. = Not Significant

Discussion and Implication

The ultimate goal of this research was to produce a psychometrically sound instrument with clear dimensionality for academic dishonesty among higher education students. The results of the EFA and CFA statistics, in part, argued for a multi-dimensional academic dishonesty. The results showed that the revised AIS is represented by three underlying factors i.e. cheating, plagiarism and research misconduct. Among the factors, cheating had the highest variance explained, followed by the research misconduct; and the least was plagiarism.

Cheating comprised seven items which reflect dishonest conducts usually perpetrated by students during a class test and/or exam, such as, copying of another student's work, and using notes during a close book examination. Plagiarism comprises three items which capture students' dishonest conducts during the group/individual take-home assignments, as well as abuse of online copyrighted materials. Examples of such behaviors include failure to acknowledge team member in a group work; and failure to acknowledge the previous studies used in a research. Similarly, research misconduct consists of four items which address other students' misconducts not in the category of cheating or plagiarism; such as, fabrication of lab results and fabrication of research data.

The three-dimensional construct in this study conforms to the previous reports, that academic dishonesty is a multi-dimensional construct (Roig and DeTommaso 1995; Ferrari 2005; Iyer and Eastman 2006; Imran 2010). For instance, Iyer and Eastman reported that academic dishonesty comprised four factors; while Roig and DeTommasso argued for two factors. Also, both cheating and plagiarism have appeared prominently in many studies where dimensionality was examined (Ferrari 2005; Iyer and Eastman 2006; Imran and Sahari 2013). However, the frequency of research misconduct as a component was not well pronounced in the literature (Imran 2010).

Regarding the psychometric of the revised AIS, this study established a strong evidence of convergent and discriminant validity, as well as internal consistency of measures, using series of statistical tests. However, unlike in the original AIS, wherein academic dishonesty consisted of four dimensions, the present study is a three-dimensional construct. Also, although, the psychometric estimates reported of the new revised AIS were not quite different from the former one, the strength of the refined AIS lies in additional tests of convergent and discriminant validity. Put together, the outcomes of this study indicate that different approaches to measure academic dishonesty yield not only the same results (convergent validity), but each sub-construct is unique and captures some phenomena which others do not (discriminant validity); and sub-constructs exhibit some degree of reliability in their measures (construct reliability) – (Hair et al. 2010).

Lastly, the three-dimensional AIS model exhibits evidence of gender invariant in the assessment of undergraduates' academic misconducts. That is, a proof that the variability in students' involvement in academic dishonesty is not moderated by the gender factor. Until now, moderating effect of gender is less investigated, especially, with structural equation modeling approach. Of course, findings abound on gender disparity in self-reported academic dishonesty. What appears relatively scarce in the literature, is the evidence that one model of academic dishonesty is useful and adequate for analyzing students' academic dishonesty across different independent groups of student populace. This evidence is possible only by showing a proof that the specified model exhibits a zero moderating effect for the particular target independent groups.

This concern is more compelling in view of the inconsistencies characterising level of involvement of male and female students in academic misconducts. While most researchers reported that more males than females were involved in this act (Jendrek 1992; McCabe and Trevino 1997; Whitley et al. 1999; Iyer and Eastman 2006; Nazir et al. 2011); others reported the opposite, i.e. more females than males were involved (Leming 1980; Lambert et al. 2003). Still, many other findings have been largely inconclusive (Thoma 1986; Jordan 2001; Malone 2006; Wotring 2007; Olasehinde 2008).

Hence, the evidence of gender-invariant in this study is a major contribution to the literature in the field, and with important implication for theory and practice in higher education. For instance, although male and female students may vary in their level of academic dishonesty, this does not mean variation with respect to the underlying factors characterizing academic dishonesty. As depicted by the present results, these underlying dimensions are necessarily the same across the gender groups of the respondents. The good side of this result is that, non-gender discriminating approaches may work out well in measures geared to curb the recurrent academic dishonesty and foster academic integrity among students of higher education. Thus, this result is unique and insightful.

Limitations

Some limitations of this research should be noted. First, caution needs be applied about generalizability of findings of this study. The reason being only undergraduates from two federal government owned universities in Nigeria and a public university in Malaysia were included in the study. Whereas, there were several other undergraduates especially from state and private universities not captured. Secondly, it would have been ideal to select more universities in each of the two countries, to allow a wider coverage of the study area, but time and resources constraint did not permit. Besides, the sampling technique approach also raises some concerns. Although quota sampling method ensures that some differences are represented in the sample (Neuman 2006), however, the technique is non-random and cannot guarantee equal representation of subjects in the population. Notwithstanding, this technique is most suitable especially in the context where the researcher is unable to assess a comprehensive list of the study's sampling frame as was the case in this study. Lastly, although efforts were made to reduce the effect of potential bias typical of response to survey instrument, still due to the sensitivity of the subject matter involved; some students may have chosen not to respond or not be truthful in their responses because of less confidence in the anonymity of the results.

Consequently, future studies are urged to consider a bigger sample size using the randomization principle. This will encourage a wider generalization of findings thereabout. Also, more studies are required to replicate and explore the possibility of additional groups' invariant effects of the revised AIS model especially, among other demographic variables such as nationality, age, and CGPA.

Appendix: Output For Average Variance Extracted And Composite Reliability

CALCULATION OF AVE = $\{\Sigma(\lambda^2) / \Sigma(\lambda^2) + \Sigma(1-\lambda^2)\}$			CALCULATION OF CR = $\{(\Sigma\lambda)^2 / (\Sigma\lambda)^2 + \Sigma(1-\lambda^2)\}$		
Components			**Components**		
1. Plagiarism	**Loadings**	**Loading^2**	**Plagiarism**	**Loadings**	**Loading^2**
Loading6^2	0.855	0.731025	Loading6	0.855	0.731025
Loading9^2	0.854	0.729316	Loading9	0.854	0.729316
Loading10^2	0.806	0.649636	Loading10	0.806	0.649636
SUM (Loading^2)		**2.11**	**SUM (Loadings)^2**	**6.3252**	
1-Loading6^2		0.268975	1-Loading6^2		0.268975
1-Loading9^2		0.270684	1-Loading9^2		0.270684
1-Loading10^2		0.350364	1-Loading10^2		0.350364
SUM (1-Loading^2)		**0.89**	**SUM (1-Loading^2)**		**0.89**
AVE		**0.703**	**CR**		**0.877**
2. Research Misconduct			**Research Misconduct**		
Loading5^2	0.918	0.842724	Loading5	0.918	0.842724
Loading7^2	0.899	0.808201	Loading7	0.899	0.808201
Loading8^2	0.894	0.799236	Loading8	0.894	0.799236
Loading11^2	0.879	0.772641	Loading11	0.879	0.772641
SUM (Loading^2)		**3.2228**	**SUM (Loadings)^2**	**12.888**	
1-Loading5^2		0.157276	1-Loading5^2		0.157276
1-Loading7^2		0.191799	1-Loading7^2		0.191799
1-Loading8^2		0.200764	1-Loading8^2		0.200764
1-Loading11^2		0.227359	1-Loading11^2		0.227359
SUM (1-Loading^2)		**0.7772**	**SUM (1-Loading^2)**		**0.7772**
AVE		**0.806**	**CR**		**0.943**
3. Cheating			**Cheating**		
Loading1^2	0.901	0.811801	Loading1	0.901	0.811801
Loading2^2	0.863	0.744769	Loading2	0.863	0.744769
Loading3^2	0.859	0.737881	Loading3	0.859	0.737881
Loading4^2	0.85	0.7225	Loading4	0.85	0.7225
Loading12^2	0.849	0.720801	Loading12	0.849	0.720801
Loading13^2	0.843	0.710649	Loading13	0.843	0.710649
Loading14^2	0.837	0.700569	Loading14	0.837	0.700569
Loading15^2	0.802	0.643204	Loading15	0.802	0.643204
SUM (Loading^2)		**5.7922**	**SUM (Loadings)^2**	**46.294**	
1-Loading1^2		0.188199	1-Loading1^2		0.188199
1-Loading2^2		0.255231	1-Loading2^2		0.255231
1-Loading3^2		0.262119	1-Loading3^2		0.262119
1-Loading4^2		0.2775	1-Loading4^2		0.2775
1-Loading12^2		0.279199	1-Loading12^2		0.279199
1-Loading13^2		0.289351	1-Loading13^2		0.289351
1-Loading14^2		0.299431	1-Loading14^2		0.299431
1-Loading15^2		0.356796	1-Loading15^2		0.356796
SUM (1-Loading^2)		**2.2078**	**SUM (1-Loading^2)**		**2.2078**
AVE		**0.724**	**CR**		**0.954**

References

Arhin, A.O. (2009). A pilot study of nursing student's perceptions of academic dishonesty: A generation Y perspective. *ABNF Journal*, 20 (1), 17.

Bates, I. P., Davies, J. G., Murphy, C., & Bone, A. (2005). A multi-faculty exploration of academic dishonesty. *Pharmacy Education*, *5*(1), 69–76.

Brown, B. S. (1996). A comparison of the academic ethics of graduate business, education, and engineering students. *College Student Journal*, *30*, 294–301.

Brown, B. S. (2000). The academic ethics of graduate business students: 1993 to 1998. *The Journal of Applied Business Research*, *16*, 105–112.

Brown, B. S., & Weible, R. (2006). Changes in academic dishonesty among MIS majors between 1999 and 2004. *Journal of Computing in Higher Education*, *18*(1), 116–134.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Sage: Newbury Park.

Byrne, M.B. (2010). Structural equation modeling with Amos: Basic concepts, application, and programming (2nd ed.). London: Routledge.

Cheung, G.W., & Rensvold, R.B. (2002). Evaluating Goodness-Of-Fit Indexes for Testing Measurement Invariance. In M.B. Byrne, (2010): Structural equation modeling with Amos: Basic concepts, application, and programming (2nd ed.). London: Routledge.

Colton, D., & Covert, R. (2007). Instrument construction, validity and reliability. In letter to the editor (2012), significance of attending to instrument planning and validation stages in nursing discipline. *Asian Nursing Research*, *6*, 82–83.

Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.,). Upper Saddle Creek, NJ: Pearson Education.

Cudeck, R., & Browne, M. W. (1983). Cross-validation of covariance structures. *Multivariate Behavioral Research*, *18*, 147–167.

Dawkins, R. L. (2004). Attributes and statuses of college students associated with classroom cheating on a small-sized campus. *College Student Journal*, *38*(1), 116–129.

Ferrari, J. R. (2005). "Imposter tendencies and academic dishonesty: Do they cheat their way to success?". *Social Behavior and Personality*, *33*(1), 11–18.

Field, A. (2005). *Discovering statistics using SPSS* (2nd ed.,). New Delhi: Sage Publications.

Fields, D. L. (2002). *Taking the measure of work: A guide to validated scales for organizational research and diagnosis*. USA: Sage Publications.

Hair, Jr, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Upper Saddle River: Pearson Education International.

Imran, A. M. (2010). IIUM students' perceptions of academic integrity practices. A dissertation submitted in partial fulfilment of the requirements for the degree of Master of Education.

Imran A. M., & Sahari, M. (2013). Predicting the underlying factors of academic dishonesty among undergraduates in public universities: a path analysis approach. *Journal of Academic Ethics, 11(2),* 103–120.

Iyer, R., & Eastman, J.K. (2006). Academic dishonesty: are business students different from other college students? *Journal of Education For Business*, 101–110.

Jendrek, M. P. (1992). Students' reactions to academic dishonesty. *Journal of College Student Development*, *33*, 260–273.

Jordan, A. E. (2001). College student cheating: The role of motivation, perceived norms, attitudes and knowledge of institutional policy. *Ethics and Behavior*, *11*(3), 233–247.

Karlins, M., Michaels, C., & Podlogar, S. (1988). An empirical investigation of actual cheating in a large sample of undergraduates. *Research in Higher Education*, *29*, 359–364.

Kidwell, L. A., Wozniak, K., & Laurel, J. P. (2003). Student reports and faculty perceptions of academic dishonesty. *Teaching Business Ethics*, *7*, 205–214.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.,). New York: The Guilford Press.

Lambert, E.G., Hogan, N.L., & Barton, S.M. (2003). Collegiate academic dishonesty revisited: what have they done, how often have they done it, who does it, and why did they do it? *Electronic Journal of Sociology*, 1-28. ISSN: 1198 3655.

Leming, J. S. (1980). Cheating behavior, subject variables, and components of the internal- external scale under high and low risk conditions. *Journal of Educational Research*, *74*(2), 83–87.

Lim, V. K. G., & See, S. K. B. (2001). Attitudes toward, and intentions to report, academic cheating among students in Singapore. *Ethics & Behavior*, *11*(3), 261–274.

MacCallum, R. C., Roznowski, M., & Necowitz, L. B. (1992). Model modifications in covariance structure analysis: the problem of capitalization on chance. *Psychological Bulletin*, *111*, 490–504.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*, 130–149.

Malone, F. L. (2006). The ethical attitude of accounting students. *Journal of American Academy of Business Cambridge*, *8*(1), 142–146.

McCabe, D. L., & Trevino, L. K. (1993). Academic dishonesty: honor codes and other contextual influences. *Journal of Higher Education*, *64*, 520–538.

McCabe, D.L., & Trevino, L.K. (1997). Individual and contextual influences on academic dishonesty: A multicampus investigation. *Research in Higher Education*, 38(3), 379-397.

Nazir, M.S., Aslam, M.S., & Nawas, M.M. (2011). Can demography predict academic dishonest behaviors of students? A case of Pakistan. *International Journal of Education Studies*, *4*(*2*), 208–218. ISSN 1913-9020 E-ISSN 1913-9039 DOI:10.5539/ies.v4n2p208.

Nelson, T., & Shaefer, N. (1986). Cheating among college students estimated with the randomized-response technique. *College Student Journal*, *20*(Fall), 321–325.

Neuman, W. L. (2006). *Social research methods qualitative and quantitative approaches* (6th ed.,). Boston: Allyn and Bacon.

Newstead, S.E., Franklyn-Stokes, A., & Armstead, P. (1996). Individual differences in student cheating. Journal of Educational Psychology, 88, 229–241.

Olasehinde, W.O. (2008). Lecturer and student sensitivity to academic dishonesty intervention approaches in the University of Ilorin, Nigeria. *Education Research Review*, *3*(*11*), 324–333. Accessed 5 July, 2011: http://www.academicjournals.org/ERR.

Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS for Windows* (*3rd edn*.). England: McGraw Hill.

Pavela, G. (1978). Judicial review of academic decision-making after Horowitz. *School Law Journal*, *55*(8), 55–75.

Rawwas, M. Y. A., & Isakson, H. R. (2000). Ethics of tomorrow's business managers: the influence of personal beliefs and values, individual characteristics and situational factors. *Journal of Education for Business*, *75*(6), 321–330.

Roig, M., & DeTommaso, L. (1995). Are college cheating and plagiarism related to academic procrastination? *Psychological Reports*, *77*, 691–698.

Swift, C. O., & Nonis, S. (1998). When no one is watching: cheating behaviors on projects and assignments. *Marketing Education Review*, *8*, 27–36.

Tabachnick, B.G., & Fidell, L.S. (2007). Using multivariate statistics (5th ed.). Boston: Pearson Education.

Thoma, S. (1986). Estimating gender differences in the comprehension and preference of moral issues. *Development Review*, *6*(1), 165–180.

Whitley, B. E., Nelson, A. B., & Jones, C. J. (1999). Gender differences in cheating attitudes and classroom cheating behavior: A Meta analysis. *Sex Roles*, *41*(9/10), 657–680.

Wotring, E. K. (2007). Cheating in the community college: generational differences among students and implications for faculty. *Inquiry*, *12*(1), 5–13.