Observational Study

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Development and validation of a questionnaire about reasons for academic cheating by nursing students

A cross-sectional study

Jazi Shaydied Alotaibi, PhD[a,*], Abdullah Obaid Alotaibi, MSc[a,b], Md Dilshad Manzar, PhD[a], Ahmed Mansour Almansour, PhD[a], Sharifa Alasiry, PhD[a], Bader A. Alrasheadi, PhD[a], Wdad Alanazy, PhD[a], Abdulrhman Albougami, PhD[a], Faizan Zaffar Kashoo, MPT[c]

Abstract

Cheating behavior is spreading among nursing students worldwide, necessitating the development of a validated questionnaire evaluating the reasons for such behavior. Nursing students (N = 482) from 2 universities in Saudi Arabia participated in this observational study. A survey containing items on socio-demographics and the 33-item Reasons for Cheating Scale (RCS) was completed by the respondents. The RCS had a 1-factor structure; the model fit indices were similar between the 1-, 2-, and 3-factor models, but the inter-factor correlations were too high for the 2- and 3-factor models. The measures of the quality of the factor score estimates were as follows: factor determinacy index, 0.987; expected a posteriori marginal reliability, 0.974; sensitivity ratio, 6.178; and expected percentage of true differences, 97.3%. The measures of the closeness to unidimensionality for the overall RCS were as follows: unidimensional congruence, 0.957; explained common variance, 0.875; and mean item residual absolute loading, 0.223. The intraclass correlation coefficient and McDonald's omega were 0.96 (CI: 0.93–0.98) and 0.962 (95% CI: 0.958–0.967), respectively. The severity score, infit, and outfit ranged from –0.847 to –2.015, 0.813 to 1.742, and 0.837 to 1.661, respectively. For all RCS items, the thresholds ranked $\tau i1 < \tau i2 < \tau i3 < \tau i4$ and showed invariance between the sexes. The RCS showed robust psychometric validity for both classical and item response theory parameters. It also had excellent test-retest reliability, internal consistency, item discrimination, factorial validity, measurement invariance, and ordered threshold level for the responses. Therefore, the RCS is a valid and reliable tool for assessing cheating behavior among nursing students.

Abbreviations: CFI = comparative fit index, ECV = explained common variance, GFI = goodness-of-fit index, NNFI = Bentler–Bonett nonnormed fit index, RCS = Reasons for Cheating Scale, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, UniCo = unidimensional congruence.

Keywords: cheating, dishonesty, factor analysis, item response theory, measurement invariance, reliability, unethical

1. Introduction

Nurses comprise about half of healthcare workers worldwide. They have a crucial role in promoting health, preventing diseases, and providing primary and community care.[1] Nursing professionals are guided by a strong set of ethical principles that form the foundation of their practice. These ethical considerations are essential to the nursing profession, as nurses have a responsibility to themselves, their colleagues, their profession, and, most importantly, their patients to uphold the highest standards of ethical conduct.[2] Nursing graduates must possess the necessary knowledge, competencies, and attitudes to provide good care for their patients and meet the demands of national health priorities.[3]

Academic integrity is a critical issue that needs concern from all individuals related to nursing education. Academic

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Informed consent was obtained from all subjects involved in the study.

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical approval to conduct the study was secured from the Ethics Standing Committee at Shaqra University (ERC_SU_20210038). The committee ensured the ethical conduct of the study.

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[a] Department of Nursing, College of Applied Medical Sciences, Majmaah University, Al Majmaah, Saudi Arabia, [b] Nursing Science and Public Health, Department of Biomedicine and Prevention, University of Rome Tor Vergata, Rome, Italy, [c] Department of Physical Therapy and Health Rehabilitation, College of Applied Medical Sciences, Majmaah University, Al Majmaah, Saudi Arabia.

** Correspondence: Jazi Shaydied Alotaibi, Department of Nursing, College of Applied Medical Sciences, Majmaah University, Al Majmaah 11952, Saudi Arabia (e-mail: jalotaibi@mu.edu.sa).*

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dishonesty is related to unethical professional practice and may be followed by the manipulation of clinical data in professional positions.[4–6] Consequently, this situation may cause long-lasting effects on students' professional development and can impact their ability to provide safe and effective nursing care in the future since they may not have the necessary knowledge and skills.[5] Cheating has detrimental effects on students' relationships with their educators and peers, particularly regarding mutual trust between students and educators.[7]

Although nursing students need to learn and practice honesty and integrity,[6,8] many studies have indicated that cheating is becoming increasingly common among these students.[4,6,8–10] In the classroom, nearly every Croatian nursing student (91.3%) engaged in dishonest behavior twice or more.[11] Another study found that up to 88% of South African nursing students admitted to engaging in dishonest behaviors at least once.[12] Further, the secondary account of observing other students cheating or indulging in academic dishonesty was high. In a study on Indian nursing students, around 84% of nursing students reported having observed academic dishonesty among their colleagues.

Unethical practices and cheating have been observed even in clinical settings, with about one-third of nursing students indulging in cheating during clinical duties.[11] There has been considerable research exploring unethical and dishonest practices and cheating in nursing students. Lovrić and Žvanut[11] reviewed original articles and summarized empirical evidence that the practice of cheating and dishonest methods is malignant among nursing students worldwide. While conventional kinds of cheating behaviors still exist, new opportunities arising from technology have made cheating more accessible to more students and more difficult to catch.[13] Because of these ever-evolving methods and trends of cheating, a continuous research effort is needed to keep up with the changing facets of cheating.[6,8,11] This continuous effort may help in exploring methods to contain and manage cheating.

The present study aimed to validate a newly developed comprehensive questionnaire for assessing the reasons for cheating behavior among nursing students. The items of the tool were developed to appraise conventional and newer methods of cheating based on recent evidence.[6,8,11,13–15] Previous questionnaires exploring cheating practices have not included comprehensive strategies and measures of validation. Therefore, in this study, an in-depth robust method employing multiple measures of classical and item response theory parameters was used to explore and establish the validity of the newly developed tool.

2. Materials and methods

2.1. Design, sampling, and setting

This cross-sectional observational study was performed among nursing students in Saudi Arabia. The first 50 participants

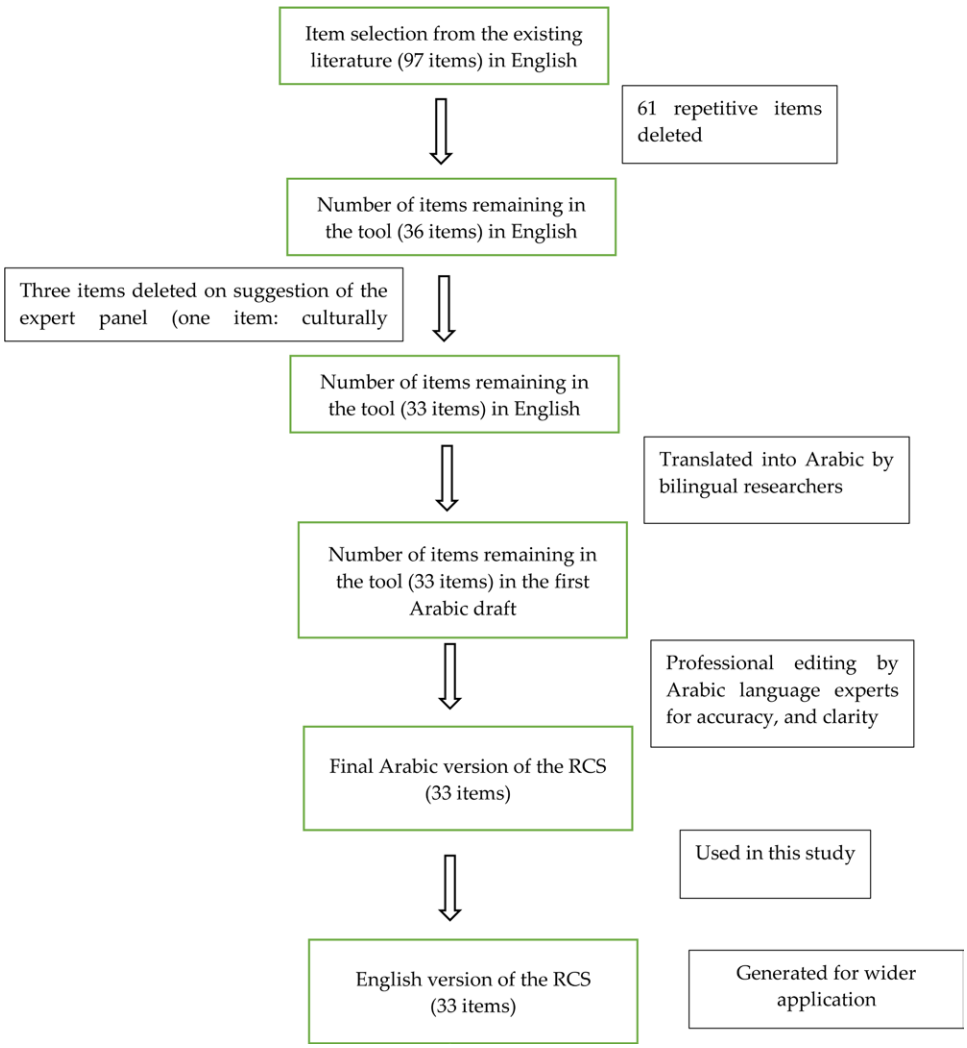

Figure 1. Flow chart showing the stages of the development of the RCS. RCS = Reasons for Cheating Scale.

completed the survey questionnaire package twice within 14 days to estimate the test-retest reliability. This study was conducted in 2 modern government universities in the Riyadh region. At the time of the study, university A, a modern university, had about 380 nursing students, while university B had about 486 students. All students in universities A and B were invited to participate in this study (a total of 866 nursing students). All nursing students who were studying in the preparatory year or in the 2nd, 3rd, or 4th year of their bachelor's degree were included in this study. In contrast, internship nursing students were excluded from this study. From the total of 866 nursing students, 482 participated in the study, yielding a response rate of 55.65%.

2.2. Procedure

The study was reviewed and approved by the Research Ethics Committee of Majmaah University (approval no. MUREC-March. 9 ICO-2022127-2) and followed the Helsinki Declaration. The survey was conducted online using Google Surveys. After the primary researcher met with the responsible authorities in the universities, a survey link was sent to the student email of all students who met the criteria, inviting them to participate in this study. A brief introductory information sheet containing the aim and procedure of the study in simple language was provided to the participants. Participation was voluntary with no incentives and/or reprisals. The students were informed about their right to withdraw at any time during the research. The contact details of the primary researcher were shared with the participants to help them communicate when they had any doubts or queries, needed more information, wanted to withdraw, or had suggestions. Data were collected with due diligence for confidentiality, and all results were published only to show group measures without revealing individual participants' identity/information. The participants completed a brief socio-demographic information sheet and a newly developed questionnaire – the Reasons for Cheating Scale (RCS).

Table 1

English version of items of Reasons for Cheating Scale.

No.	Items
1	Lack of desire to study
2	Students used to cheat in previous academic stages
3	Not understanding the course material
4	Exams are too hard
5	Exams do not test what you have learnt
6	Some test questions and test instructions are not clear
7	Weak punishment for cheating
8	Not preparing well before exams
9	Not paying attention in class since students know that they can eventually cheat when an exam comes
10	Teacher's lack of competence in explaining the subject material
11	The existence of family circumstances hinders students from being adequately prepared for the exam
12	Fear of failing the exam
13	High pressures and expectations from students' families to excel in studies
14	Having more than one exam on the same day
15	Lecturers or invigilators leaving the examination room during the exams
16	Low educational level of students' family
17	Lack of awareness or guidance about the harmful effects of cheating and the importance of students being honest
18	Large number of academic subjects that student's study in a single semester
19	Students who are friends feel obligated to help each other during exams
20	Low self-confidence
21	Difficulty of the course material
22	Dissatisfaction with the examination process
23	Convergence of seats in the examination hall
24	Use of modern technologies, such as cell phones, for the purpose of cheating
25	Desire to obtain high grades
26	Desire to please the family with success and superiority
27	Encouragement of students' friends to cheat in the examination
28	Not having a suitable place to study at home
29	Fear of bullying and reprimand from family and friends
30	The fact that Cheating is morally acceptable among students
31	The fact that Cheating is socially acceptable
32	Indulgence of some lecturers while observing the exam
33	Ignorance of the right way to study

2.3. Reasons of Cheating Scale in Nursing Students (RCS: Tool development)

The questionnaire items were derived from previous studies.[5,6,8,12,14,15] These studies were diligently explored to identify items for the prospective questionnaire to assess the reasons for cheating behavior among nursing students. The flow chart of the tool development is shown in Figure 1. Initially, a set of 97 items were identified (Fig. 1). From this initial set of items, the researchers removed all repetitive questions, yielding 36 remaining questions. Thereafter, the questions were sent to a panel of

Table 2

Demographic data of participants.

Characteristics	Numbers (%)
Age (year)	
15–19	172 (35.7%)
20–24	277 (57.5%)
25–30	33 (6.8%)
Sex	
Male	279 (57.9%)
Female	203 (42.1%)
University	
University A	218 (45.2%)
University B	264 (54.8%)
Marital status	
Married	14 (2.9%)
Single	468 (97.1%)
Year of study	
Preparatory year	80 (16.6%)
Second year	184 (38.2%)
Third year	93 (19.3%)
Fourth year	125 (25.9%)

Table 3

Multivariate descriptive parameters, sample size adequacy, and quality and effectiveness of the factor score measures of the Reasons for Cheating Scale (RCS) scores among university students.

Measures	Values
Multivariate descriptive parameters	
Mardia's skewness	X^2 (df = 6545) = 12,315.797, $P = 1.00$
Mardia's kurtosis	$X^2 = 55.718$, $P < .05$
Quality and effectiveness of the factor score estimates*	
Factor determinacy index	0.987
Expected a posteriori marginal reliability	0.974
Sensitivity ratio	6.178
Expected percentage of true differences	97.3%
Sample size adequacy	
Bartlett's test of sphericity	X^2 (df = 528) = 5413.0, $P < .001$
Determinant	0.000001
KMO (95% confidence interval)	0.956 (0.921–0.972)

Kaiser-Meyer-Olkin Test of Sampling Adequacy (KMO).

*For the 1-factor structure of the RCS.

external reviewers comprising 5 experts with extensive experience in nursing education in Saudi Arabia. The external panel reviewed the instrument based on the requirements of satisfying the content validity. According to the suggestions of the expert reviewers, 3 questions were removed, making the total number of questions 33. Moreover, the wording of some items was slightly revised as suggested. This preliminary version of the RCS was translated into Arabic by bilingual researchers. This first Arabic version of the RCS was edited for language accuracy and clarity by professional Arabic editors. This Arabic version was the tool used in this study (Supplement 1, http://links.lww.com/MD/M650). The Arabic RCS was further back-translated for wider understanding and accessibility by researchers worldwide (Supplement 1, http://links.lww.com/MD/M650). This tool had 3 prospective dimensions of cheating: personal reasons for cheating, social reasons for cheating, and academic reasons for cheating. The responses were recorded on a Likert-type scale with a similar scoring pattern for all 33 items based on the

Table 4

Closeness to dimensionality measures communality and factor loadings of the Reasons of Cheating Scale scores (RCS) in university students.

					Factor loading*				
	I-UniCo	I-ECV	I-REAL	Communality (h^2)*	Estimate	Standard error	z-value	*P*	Normed MSA
Q1	0.999	0.959	0.136	0.42	0.64	0.01	69.61	<.001	0.96
Q2	0.997	0.926	0.206	0.53	0.72	0.01	82.92	<.001	0.96
Q3	1.000	0.988	0.079	0.49	0.69	0.01	76.62	<.001	0.95
Q4	0.973	0.807	0.328	0.46	0.67	0.01	70.72	<.001	0.93
Q5	1.000	0.981	0.093	0.45	0.66	0.01	72.48	<.001	0.95
Q6	0.976	0.819	0.280	0.35	0.59	0.01	63.29	<.001	0.94
Q7	0.986	0.854	0.310	0.58	0.75	0.01	88.24	<.001	0.97
Q8	1.000	0.999	0.024	0.54	0.73	0.01	84.76	<.001	0.96
Q9	0.994	0.898	0.264	0.62	0.79	0.01	97.05	<.001	0.96
Q10	1.000	0.999	0.025	0.53	0.72	0.01	84.12	<.001	0.97
Q11	1.000	0.994	0.058	0.53	0.72	0.01	83.49	<.001	0.96
Q12	0.927	0.713	0.411	0.41	0.64	0.01	66.32	<.001	0.95
Q13	0.881	0.651	0.457	0.38	0.61	0.01	63.30	<.001	0.95
Q14	0.997	0.924	0.191	0.42	0.64	0.01	68.59	<.001	0.96
Q15	0.975	0.814	0.363	0.61	0.77	0.01	93.75	<.001	0.96
Q16	0.998	0.946	0.183	0.58	0.75	0.01	89.84	<.001	0.97
Q17	0.999	0.968	0.142	0.59	0.77	0.01	91.71	<.001	0.97
Q18	0.992	0.887	0.256	0.50	0.70	0.01	80.28	<.001	0.97
Q19	1.000	0.987	0.088	0.57	0.75	0.01	90.40	<.001	0.97
Q20	1.000	0.983	0.101	0.59	0.77	0.01	94.23	<.001	0.96
Q21	0.964	0.783	0.378	0.51	0.72	0.01	81.82	<.001	0.96
Q22	0.999	0.954	0.169	0.57	0.75	0.01	88.09	<.001	0.97
Q23	0.995	0.913	0.234	0.60	0.77	0.01	94.17	<.001	0.96
Q24	0.993	0.894	0.270	0.65	0.81	0.01	102.92	<.001	0.95
Q25	0.437	0.327	0.623	0.24	0.50	0.01	46.68	<.001	0.78
Q26	0.541	0.391	0.619	0.30	0.55	0.01	52.87	<.001	0.82
Q27	0.998	0.934	0.207	0.62	0.78	0.01	98.14	<.001	0.96
Q28	1.000	0.997	0.043	0.54	0.73	0.01	87.22	<.001	0.95
Q29	1.000	0.996	0.053	0.63	0.79	0.01	98.03	<.001	0.96
Q30	1.000	0.973	0.128	0.60	0.77	0.01	94.70	<.001	0.95
Q31	0.995	0.911	0.238	0.60	0.78	0.01	94.74	<.001	0.95
Q32	0.974	0.810	0.365	0.61	0.77	0.01	95.50	<.001	0.97
Q33	1.000	0.997	0.041	0.50	0.70	0.01	78.40	<.001	0.97
Overall	0.957	0.875	0.223						0.95

*Diagonally weighted least squares for unrotated solution.

A value of ECV and I-ECV larger than 0.85 suggests that data can be treated as essentially unidimensional.

A value of MIREAL and I-REAL lower than 0.300 suggests that data can be treated as essentially unidimensional.

ECV = explained common variance); I-ECV = item explained common variance, I-REAL = item residual absolute loadings, I-UniCo = item unidimensional congruence, MIREAL = mean of item residual absolute loadings, MSA = Kaiser's single-variable measure of sampling adequacy, SD = standard deviation, SE = standard error, UniCo = unidimensional congruence.

Table 5

Fit statistics of the Reasons for Cheating Scale scores among the university students.

Models	GFI	NNFI	CFI	SRMR	RMSEA	χ^2	df	*P*
One-factor model	0.975	0.974	0.976	0.082	0.111	3423.801	495	<.001
Three-factor model	0.976	0.975	0.977	0.082	0.109	3310.150	492	<.001
Two-factor model	0.976	0.975	0.977	0.082	0.109	3317.129	494	<.001

Interfactor correlation coefficients in the 3-factor model: F1–F2 (R = 0.94), F2–F3 (R = 0.97), and F1–F3 (R = 0.93).

Interfactor correlation coefficients in the 2-factor model: F1–F2 (R = 0.94).

CFI = comparative fit index, GFI = goodness-of-fit index, NNFI = Bentler–Bonett nonnormed fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual.

frequency of the self-reported reasons for cheating ranging from 1 (totally disagree) to 5 (totally agree). The tool was originally developed in Arabic, and this version underwent translation and back translation to develop an English version (Table 1, Supplementary File 1a, http://links.lww.com/MD/M650) as well. In this study, the original Arabic version (Supplementary File 1b, http://links.lww.com/MD/M650) was used.

2.4. Data analysis

The data were analyzed using 4 software programs: SPSS 23.0, JASP 0.17.0.0, Factor 12.03.02, and JAMOVI 2.3.18. Descriptive statistics measures, McDonald's omega, and item–rest correlation were determined (detail in Supplement File 2, http://links.lww.com/MD/M651).

Further, assumptions of the factor analysis and the quality and effectiveness of the factor score estimates were determined (detail in Supplement File 2, http://links.lww.com/MD/M651). Confirmatory factor analysis was performed on 3 models: a 3-factor model with dimensions of social, personal, and academic reasons for cheating; a 2-factor model with academic and nonacademic factors of the reasons for cheating; and a 1-factor model (detail in Supplement File 2, http://links.lww.com/MD/M651). Additional indices for assessing the robustness of a unidimensional solution were estimated (detail in Supplement File 2, http://links.lww.com/MD/M651).[16–18] The goodness-of-fit index (GFI), Bentler–Bonett nonnormed fit index (NNFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and chi-square statistics were estimated. A GFI, NNFI, and CFI of 0.95 indicated an excellent model fit. A great model fit was noted when the chi-square statistics were nonsignificant, the SRMR was 0.08 or below, and the RMSEA was low.[17–19]

The Polytomous Rating Scale Model was adopted to estimate the item difficulty, information-weighted fit statistic (infit) mean square and outlier-sensitive fit statistic (outfit) mean square, and thresholds (i1, i2, i3, and i4), and differential item function test (detail in Supplement File 2, http://links.lww.com/MD/M651).[20–23]

3. Results

3.1. Participant characteristics

The majority of the participating nursing students were aged 20 years and above (64.3%), were men (57.9%), and were from University B (54.8%) (Table 2). Most participants were single (97.1%). Second- and third-year students comprised the majority of the study sample (57.5%) (Table 2).

3.2. Factor analysis: Data suitability and sample adequacy

The data did not have multivariate Mardia's skewness [χ^2 (6545) = 12,315.797, $P = 1.00$] but violated multivariate Mardia's kurtosis ($\chi^2 = 55.718$, $P < .05$) (Table 3). Bartlett's test

Table 6

Item analysis: Classical theory parameters of the Reasons for Cheating Scale scores among the university students.

	Skewness			Kurtosis			McDonald's ω for deleted	
	Statistics	SE	Z	Statistics	SE	Z	items	Item–rest correlation
Q1	0.22	0.11	1.96	−0.66	0.22	−2.95	0.96	0.59
Q2	0.28	0.11	2.52	−1.14	0.22	−5.13	0.96	0.65
Q3	0.26	0.11	2.32	−0.68	0.22	−3.06	0.96	0.63
Q4	0.59	0.11	5.28	−0.29	0.22	−1.31	0.96	0.59
Q5	0.28	0.11	2.49	−0.96	0.22	−4.34	0.96	0.59
Q6	0.27	0.11	2.46	−0.71	0.22	−3.18	0.96	0.52
Q7	−0.13	0.11	−1.14	−1.33	0.22	−6.00	0.96	0.68
Q8	0.33	0.11	2.97	−0.96	0.22	−4.32	0.96	0.68
Q9	0.04	0.11	0.35	−1.30	0.22	−5.86	0.96	0.71
Q10	0.15	0.11	1.31	−0.95	0.22	−4.27	0.96	0.67
Q11	0.26	0.11	2.32	−0.82	0.22	−3.68	0.96	0.67
Q12	0.65	0.11	5.81	−0.45	0.22	−2.00	0.96	0.57
Q13	0.62	0.11	5.60	−0.50	0.22	−2.25	0.96	0.54
Q14	0.34	0.11	3.10	−0.82	0.22	−3.68	0.96	0.59
Q15	−0.16	0.11	−1.47	−1.30	0.22	−5.84	0.96	0.68
Q16	−0.19	0.11	−1.73	−1.18	0.22	−5.33	0.96	0.69
Q17	0.12	0.11	1.06	−1.24	0.22	−5.59	0.96	0.70
Q18	0.47	0.11	4.26	−0.73	0.22	−3.29	0.96	0.64
Q19	0.24	0.11	2.14	−1.06	0.22	−4.76	0.96	0.70
Q20	0.08	0.11	0.70	−1.14	0.22	−5.12	0.96	0.71
Q21	0.41	0.11	3.72	−0.56	0.22	−2.52	0.96	0.65
Q22	0.22	0.11	2.01	−0.87	0.22	−3.93	0.96	0.70
Q23	−0.01	0.11	−0.06	−1.17	0.22	−5.27	0.96	0.69
Q24	0.04	0.11	0.40	−1.33	0.22	−6.01	0.96	0.71
Q25	0.87	0.11	7.87	−0.34	0.22	−1.55	0.96	0.37
Q26	0.86	0.11	7.70	−0.28	0.22	−1.27	0.96	0.42
Q27	−0.03	0.11	−0.23	−1.26	0.22	−5.65	0.96	0.71
Q28	0.06	0.11	0.50	−1.02	0.22	−4.57	0.96	0.67
Q29	0.16	0.11	1.44	−1.17	0.22	−5.27	0.96	0.74
Q30	0.18	0.11	1.58	−1.22	0.22	−5.47	0.96	0.69
Q31	−0.07	0.11	−0.63	−1.30	0.22	−5.87	0.96	0.69
Q32	−0.09	0.11	−0.85	−1.18	0.22	−5.32	0.96	0.69
Q33	0.37	0.11	3.31	−0.89	0.22	−4.00	0.96	0.65

*$P < .05$; *$P < .001$.

SD = standard deviation, SE = standard error.

of sphericity yielded significant findings [χ^2 (210) = 3314.75, $P < .001$]. The overall Kaiser-Meyer-Olkin criterion for the RCS tool was 0.956, with a range of 0.78 to 0.97 for the individual items (Table 4), while the determinant of the matrix was more than 0.00001. The communality for the RCS items was 0.24 and above, with values being >0.4 for most items (Table 4).

3.3. Factor analysis: Confirmatory factor analysis

All 3 models, that is, 1-factor, 2-factor, and 3-factor had similar values for the multiple fit indices: GFI, NNFI, and CFI (all above 0.975); SRMR (all 0.082); RMSEA (all above 0.08); and significant chi-square test values (Table 5). However, both the 2- and 3-factor models had high inter-factor correlation coefficients. The interfactor correlation coefficients in the 3-factor model were: F1 to F2 ($R = 0.94$), F2 to F3 ($R = 0.97$), and F1 to F3 ($R = 0.93$, the interfactor correlation coefficients in the 2-factor model was $R = 0.94$). The 1-factor model had an average factor loading of 0.71 (Table 4).

3.4. Factor analysis: Quality and effectiveness of the factor score estimates and closeness to unidimensionality

The values of measures to determine the quality of the factor score estimates were as follows: factor determinacy index = 0.987, expected a posteriori marginal reliability = 0.974, sensitivity ratio = 6.178, and expected percentage of true differences = 97.3% (Table 3). The measures of closeness to unidimensionality for the overall RCS tool such as were as follows: UniCo = 0.957, explained common variance (ECV) = 0.875, and MIREAL = 0.223 (Table 4). The values of measures to determine closeness to unidimensionality for the overall RCS tool such as UniCo, ECV, and MIREAL were 0.957, 0.875, and 0.223, respectively (Table 3). The item-level I-UniCo varied from 0.437 to 1.00, with 2 items having values <0.95 (Q25 and Q26) (Table 4). The item explained common variance varied from 0.327 to 0.99, with 8 items having values <0.85 (Q4, Q12, Q13, Q15, Q21, Q25, Q26, and Q32) (Table 3). The item residual absolute loading varied from 0.024 to 0.623, with 8 items having values more than 0.300 (Q4, Q12, Q13, Q15, Q21, Q25, Q26, and Q32) (Table 4).

3.5. RCS item analysis: Classical theory parameters, test-retest reliability, internal consistency, and item discrimination

For all 33 items of the RCS, the absolute values of skewness ranged from 0.87 to 0.01, while the absolute values of kurtosis ranged from 1.33 to 0.28 (Table 6).

The intraclass correlation coefficient was 0.96 (CI: 0.93–0.98) for the total RCS score. The RCS had a McDonald's omega of 0.962 (95% CI: 0.958–0.967). McDonald's omega for deleted items did not vary across the 33 items of the RCS, with a value of 0.96 for all of them (Table 6). The item–rest correlation coefficients for the RCS ranged from 0.37 to 0.74.

Table 7

Summary of the item difficulty, polytomous mean square fit statistics (infit and outfit), and threshold statistics of the Rating Scale Model-Based Reasons for Cheating Scale scores among the university students.

	Severity score	SE	Outfit MnSq	Infit MnSq	Threshold 1	Threshold 2	Threshold 3	Threshold 4
Q1	−1.549	0.046	0.960	1.192	−1.130	−0.066	1.209	1.966
Q2	−1.556	0.046	1.086	1.096	−0.695	0.187	0.873	1.441
Q3	−1.346	0.047	0.813	0.841	−0.864	0.168	1.423	2.538
Q4	−0.913	0.050	0.849	0.880	−0.461	0.763	2.010	3.183
Q5	−1.438	0.047	1.092	1.107	−0.648	0.162	1.072	1.937
Q6	−1.311	0.047	1.096	1.166	−0.712	0.176	1.458	2.475
Q7	−1.935	0.046	1.123	1.071	−0.773	−0.190	0.458	1.062
Q8	−1.399	0.047	0.937	0.914	−0.566	0.219	1.093	1.872
Q9	−1.775	0.046	1.014	0.959	−0.732	−0.046	0.631	1.231
Q10	−1.624	0.046	0.932	0.965	−0.857	−0.103	0.985	1.656
Q11	−1.483	0.046	0.855	0.858	−0.869	0.075	1.150	1.945
Q12	−1.007	0.049	1.057	1.101	−0.236	0.592	1.603	2.329
Q13	−1.045	0.049	1.099	1.178	−0.298	0.579	1.531	2.321
Q14	−1.392	0.047	1.034	1.131	−0.816	0.255	1.165	2.097
Q15	−2.013	0.046	1.107	1.050	−0.945	−0.263	0.436	0.966
Q16	−2.015	0.046	1.037	0.958	−0.992	−0.372	0.458	1.089
Q17	−1.708	0.046	1.050	1.002	−0.648	−0.045	0.776	1.212
Q18	−1.304	0.047	0.953	0.923	−0.592	0.346	1.255	1.861
Q19	−1.602	0.046	0.954	0.889	−0.818	0.063	0.923	1.460
Q20	−1.743	0.046	0.931	0.865	−0.874	−0.118	0.773	1.369
Q21	−1.291	0.047	0.824	0.837	−0.818	0.311	1.435	2.264
Q22	−1.498	0.046	0.831	0.863	−0.734	0.008	1.138	1.844
Q23	−1.821	0.046	0.996	0.944	−0.953	−0.171	0.651	1.353
Q24	−1.817	0.046	1.075	0.994	−0.783	−0.048	0.628	1.070
Q25	−0.847	0.051	1.742	1.661	0.196	0.730	1.465	2.039
Q26	−0.893	0.050	1.556	1.494	0.057	0.733	1.491	2.004
Q27	−1.842	0.046	0.973	0.981	−0.875	−0.137	0.585	1.253
Q28	−1.777	0.046	0.925	0.929	−1.092	−0.211	0.802	1.468
Q29	−1.661	0.046	0.896	0.843	−0.741	0.009	0.818	1.368
Q30	−1.685	0.046	1.025	0.972	−0.830	0.070	0.764	1.297
Q31	−1.922	0.046	1.092	1.060	−0.917	−0.172	0.525	1.060
Q32	−1.899	0.046	1.009	0.983	−0.952	−0.263	0.564	1.270
Q33	−1.353	0.047	0.964	1.077	−0.544	0.250	1.173	1.931

Data were calculated using the eRm R package.

3.6. RCS item analysis: Rasch rating scale model parameters

The severity score ranged from −0.847 (item 25) to −2.015 (item 16) (Table 7). The infit and outfit statistics of the RCS item scores were 0.813 to 1.742 and 0.837 to 1.661, respectively (Table 7). The Wright map showed that the item difficulty level of the RCS items mostly corresponded with the moderate person ability level (Fig. 2). The thresholds were ranked τi1 < τi2 < τi3 < τi4 for each of the 33 RCS item scores (Table 7). All RCS items showed invariance between the sexes, as the *P* values were nonsignificant for the likelihood ratio chi-square statistics at adjusted *P* values for both uniform and nonuniform estimates (Table 8).

The Wright map (Fig. 2) showed that the width of the spread of the person ability shown on the left panel and item difficulty level on the right panel did not match. This finding implies that more efforts are needed to possibly add both simple and difficult items based on the difficulty level. Such efforts may help attain a comparative width of the ability distribution with the item difficulty level.[24]

4. Discussion

To the best of our knowledge, this study is the first to document the validation of a questionnaire assessing the reasons for cheating behavior among nursing students using robust psychometric measures of both classical and item response theory parameters. Most previous research has overly relied on classical theory parameters to explore the psychometric properties of tools for assessing cheating in nursing students.[6,8,14,15] In summary, the present study found evidence of robust psychometric validation measures of the newly developed RCS including test-retest reliability, internal consistency, item discrimination, factorial validity, measurement invariance, and ordered threshold level for the responses to the RCS items.

4.1. Factor analysis: Data suitability and sample adequacy

Recent systematic reviews and meta-analyses on factorial validity suggest that it is desirable to report multiple indices of data suitability when performing factor analyses.[17,18] Therefore, in this study, several tests were performed to assess the suitability of the data for factor analysis. In this study, Mardia's kurtosis showed a deviation from the multivariate normality condition; therefore, confirmatory factor analysis was performed using the diagonally weighted least square estimation method. The choice of the estimation method was based on previous studies that have shown that this method provides more accurate estimates in conditions of nonnormality.[25]

The RCS item scores were significantly correlated, and the correlation matrix could not happen by chance as implied by the significant value in Bartlett's test of sphericity.[26] In this study, all individual item-level measure of sampling adequacy values of the RCS were 0.78 or above. Therefore, all 33 items of the RCS satisfied the item inclusion criteria.[27] Furthermore, the overall Kaiser-Meyer-Olkin of the RCS, which was the weighted average of the individual item-level measure of sampling adequacy,

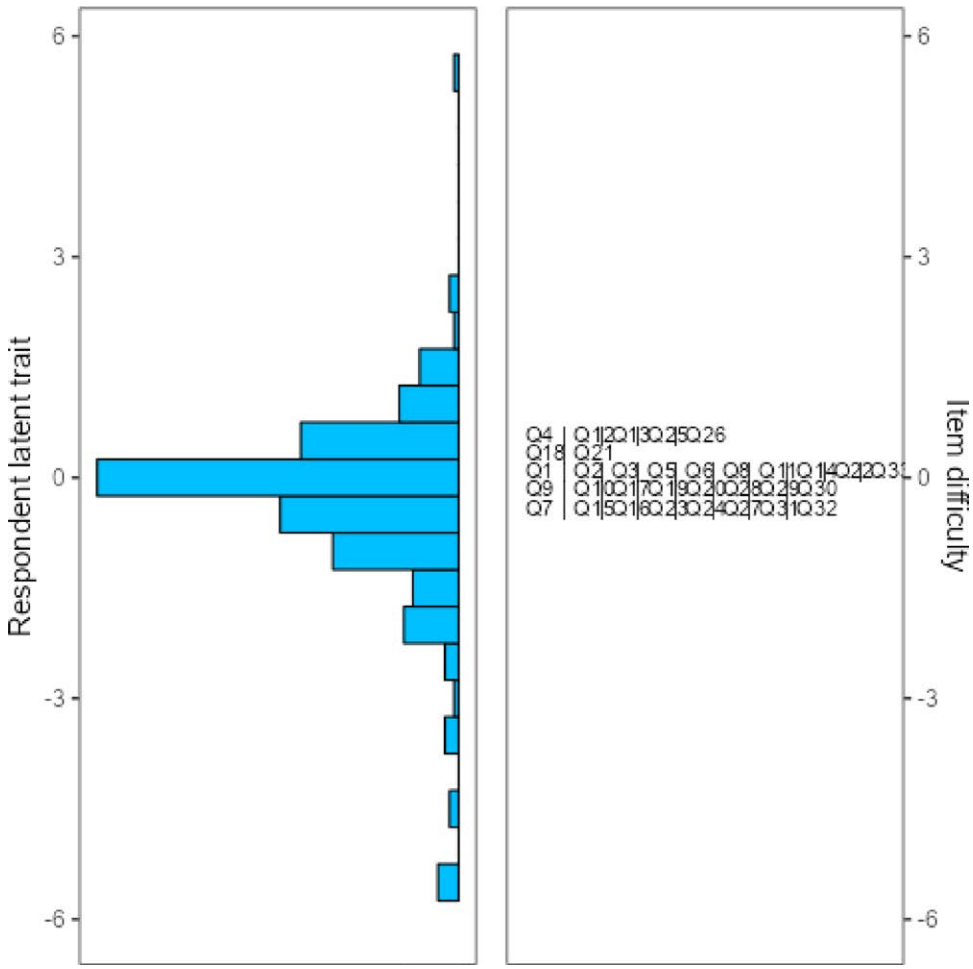

Figure 2. Wright's map of the person-item distribution of the individual items of the RCS among the university students. Q1 to Q33 are items of the RCS. RCS = Reasons for Cheating Scale.

was 0.956, implying an excellent level of shared variance among the RCS items.[27,28] The value of the determinant (>0.00001) showed that the RCS item scores did not have problems of singularity or multicollinearity.[28] In this study, the communality for the RCS items was 0.24 and above. Therefore, all 33 items of the RCS satisfied the item inclusion criteria. In brief, the present study is one of the few studies on the psychometrics of questionnaires assessing the reasons for cheating behavior that performed a factor analysis after verifying data suitability and assumptions using multiple indices.

4.2. Factor analysis: Confirmatory factor analysis

Although all factor structures had similar fit indices in this study, the validity of the 2- and 3-factor structures was compromised by the high inter-factor correlations. The high inter-factor correlations violated the divergent validity criteria for distinct factor constructs.[17] Therefore, the parsimonious 1-factor structure was found to be more representative of the RCS scores. However, this 1-factor model did not agree with the 3-factor construct that was conceptually determined to comprise the items of the RCS. Therefore, a higher-order factor structure comprising the 3 subfactors – a bi-factor model – was tested. However, the bi-factor model was not deemed to be valid, as it had low factor loading for the 2 subfactors. In summary, the 1-factor structure was the favored solution for the RCS. Additional support for the validity of this 1-factor structure was indicated by the high average factor loading.[29] Amawi and El Sayyed[14] suggested that there are 3 factors for the reasons for cheating. However, notably, the authors based their deductions on a conceptual framework without providing statistical evidence for the proposed factor structure of a tool with 52 items.[14] A study conducted in South Korea suggested that a tool with 26 items assessing the reasons for cheating may be classified into 2 major factors. These 2 factors were proposed to comprise 4 subfactors.[6] However, the authors also based their proposition only on conceptual construct formation without providing statistical support.[6]

4.3. Factor analysis: Quality and effectiveness of the factor score estimates and closeness to unidimensionality

It is advised to employ factor scores with a factor determinacy index above 0.90, marginal reliability above 0.80, sensitivity ratio above 2, and expected percentage of true differences over 90% if factor scores are to be effectively used in individual assessments. The factor score estimates of the RCS in this study satisfied these 4 statistical criteria, thereby providing additional support for the validity of the 1-factor structure of the questionnaire.[16] Further support to the 1-factor structure of the RCS was provided by the overall indices including the UniCo, ECV, and MIREAL. All of these parameters were in the required range: UniCo above 0.95, ECV above 0.85, and MIREAL below 0.3.[16] However, the individual item-level values of these indices indicated that some of the RCS items did not support the unidimensional factor structure. A closer inspection of these nonconforming items showed that 2 items (item 25 and item 26) did not

Table 8

Differential item function (DIF) test: Reasons of Cheating Scale (RCS) scores in university students across gender groups.

	Uniform DIF estimate			Nonuniform DIF estimate		
RCS items	**Likelihood ratio chi-square statistics**	**Unadjusted *P*-value**	**Adjusted *P*-value**	**Likelihood ratio chi-square statistics**	**Unadjusted *P*-value**	**Adjusted *P*-value**
Q1	1.218	.270	1.000	0.335	.563	1.000
Q2	0.005	.945	1.000	2.927	.087	1.000
Q3	0.233	.629	1.000	0.790	.374	1.000
Q4	3.057	.080	1.000	1.716	.190	1.000
Q5	1.558	.212	1.000	1.866	.172	1.000
Q6	0.000	.986	1.000	2.003	.157	1.000
Q7	7.978	.005	.156	0.041	.839	1.000
Q8	0.094	.759	1.000	0.040	.842	1.000
Q9	2.993	.084	1.000	1.359	.244	1.000
Q10	8.153	.004	.142	2.712	.100	1.000
Q11	0.142	.706	1.000	0.195	.658	1.000
Q12	2.379	.123	1.000	0.071	.790	1.000
Q13	0.786	.375	1.000	2.312	.128	1.000
Q14	1.190	.275	1.000	0.779	.377	1.000
Q15	0.120	.729	1.000	0.150	.698	1.000
Q16	1.950	.163	1.000	0.070	.791	1.000
Q17	1.178	.278	1.000	2.802	.094	1.000
Q18	3.410	.065	1.000	1.169	.280	1.000
Q19	4.196	.041	1.000	1.530	.216	1.000
Q20	0.087	.767	1.000	3.677	.055	1.000
Q21	1.137	.286	1.000	0.119	.730	1.000
Q22	0.009	.922	1.000	0.001	.974	1.000
Q23	0.354	.552	1.000	2.750	.097	1.000
Q24	0.374	.541	1.000	2.524	.112	1.000
Q25	7.580	.006	.195	0.032	.858	1.000
Q26	5.821	.016	.523	0.843	.358	1.000
Q27	0.008	.929	1.000	4.047	.044	1.000
Q28	2.738	.098	1.000	4.754	.029	.965
Q29	0.000	.990	1.000	7.954	.005	.158
Q30	1.874	.171	1.000	0.763	.382	1.000
Q31	1.445	.229	1.000	0.506	.477	1.000
Q32	3.541	.060	1.000	1.462	.227	1.000
Q33	0.089	.766	1.000	5.648	.017	.577

DIF = differential item function, RCS = Reasons for Cheating Scale.

satisfy any of the 3 criteria (i.e., I-UniCo, item explained common variance, and item residual absolute loading).[16] Therefore, future studies may explore the effects of editing or deleting these items on the factorial validity and overall validity of the RCS.

4.4. RCS item analysis: Classical theory parameters, test-retest reliability, internal consistency, and item discrimination

As the sample size of the present study was more than 300, absolute values of the skewness and kurtosis statistics were used to determine major deviations from the univariate normality distribution requirements.[30] No major problems of the univariate distribution requirement were identified in the RCS item scores based on the absolute values of skewness that did not exceed 2 and the absolute values of kurtosis that did not exceed 7.[30]

The test-retest reliability of the RCS was excellent as implied by an intraclass correlation coefficient of 0.95.[31] Previous studies have not reported the test-retest reliability of different versions of questionnaires developed to assess the reasons for cheating among nursing students.[6,8,14,15] McDonald's omega showed that the internal consistency of the RCS was excellent in the study sample. Furthermore, the individual item-level McDonald's omega for deleted items did not vary much, indicating that all items of the RCS contribute equally to its reliability.[18] As all item–rest correlation coefficients and McDonald's omega for deleted items were above the criteria, the RCS was considered to have adequate item discrimination.[32]

4.5. RCS item analysis: Rasch Rating Scale model parameters

Robust Rasch Rating Scale parameters have been rarely utilized in nursing research in general. In the present study, item 25 and item 16 were the easiest and most difficult items, respectively.[33] The severity score had a narrow range as indicated by all values in the negative range. Therefore, future studies may modify the items of the RCS to make them more representative of a wider spectrum of severity to help improve the tool's psychometric performance.[33] The lowest range of the infit and outfit was higher than that expected for the rating survey. The lowest range showed that the items of the RCS were similar to those of a high-stake multiple-choice questionnaire.[34] The Wright map (Fig. 2) revealed that the item difficulty level on the right panel and the width of spread of the ability level (left panel) were not as desired for an ideal tool. This finding implies that more efforts are needed to possibly add both simple and difficult items based on the difficulty level. Such efforts may help attain a comparative width of the person ability distribution with the item difficulty level.[24] The orderly nature of the threshold values of all 33 items of the RCS provided credence to the response category level used.[20] Furthermore, the validity of the RCS was lent credence by the establishment of the item-level invariance across the sex groups for all 33 items. Therefore, the robust measures of the Rasch Rating Scale Model support the validity of the RCS and provide additional areas that can be focused on by future studies to further improve the psychometric validity of the tool.

5. Conclusions

The newly developed 33-item RCS showed robust psychometric validation measures among Saudi nursing students. The RCS had excellent test-retest reliability, internal consistency, item discrimination, factorial validity, measurement invariance, and ordered threshold level for the responses to the RCS items. The limitation of the study includes the inclusion of students of only one discipline. Therefore, it is necessary to assess the validity of the RCS in future works to understand its applicability to students of other health science courses. Future research efforts to develop a brief version of the RCS may help in increasing a wider application. Future studies among health sciences students from multi-country data collection centers may help evaluate the impact of cultural aspects on the validity of the RCS. Herein, the structural validity across socio-demographics was not explored. Future studies with a longitudinal design may help explore the temporal measurement invariance of the structure of the RCS.

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Author contributions

Conceptualization: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Wdad Alanazy, Abdulrhman Albougami, Faizan Zaffar Kashoo.
Data curation: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Wdad Alanazy, Abdulrhman Albougami, Faizan Zaffar Kashoo.
Formal analysis: Md Dilshad Manzar, Faizan Zaffar Kashoo.
Funding acquisition: Abdullah Obaid Alotaibi, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Wdad Alanazy, Abdulrhman Albougami.
Investigation: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar.
Methodology: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar.
Project administration: Jazi Shaydied Alotaibi.
Resources: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Abdulrhman Albougami.
Software: Md Dilshad Manzar.
Validation: Md Dilshad Manzar, Wdad Alanazy.
Visualization: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Abdulrhman Albougami.
Writing – original draft: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Wdad Alanazy, Abdulrhman Albougami, Faizan Zaffar Kashoo.
Writing – review & editing: Jazi Shaydied Alotaibi, Abdullah Obaid Alotaibi, Md Dilshad Manzar, Ahmed Mansour Almansour, Sharifa Alasiry, Bader A. Alrasheadi, Wdad Alanazy, Abdulrhman Albougami, Faizan Zaffar Kashoo.

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