








Peer-Assessment Academic Integrity Scale (PAAIS-24)

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Abstract

This study aims to develop an academic integrity scale to help lecturers evaluate the academic integrity of university students with peer-assessment learning experiences using the ADDIE research and development method. Twenty-four items were designed using the concepts of academic integrity; honesty, trust, fairness, respect, responsibility, and courage validated by six raters and tested on 520 students from various universities in Indonesia. Testing content validity using the Aiken-V formula, construct validity testing using discriminant indexes, factor analysis (Exploratory and Confirmatory Factor Analysis), and concurrent validity testing by correlating PAAIS-24 with the developed Academic Integrity Scale. While the reliability test used Cronbach's alpha formula. The study results proved that each item of content validity meets with an Aiken value >0.80 ; on construct validity testing, the discriminant index value is >0.50 , and the EFA and CFA loading factor values are >0.50 . In addition, the model is appropriate because the theoretical model of PAAIS-24 is in accordance with empirical data. Whereas in reliability testing, Cronbach's alpha value is 0.95. Lastly, PAAIS-24 is one of the credible instruments. It contributes to developing knowledge that assists lecturers in measuring, assessing, and evaluating student academic integrity based on peer-assessment to promote increased academic performance.

Keywords:

Peer-assessment Instrument;
Academic Integrity Scale;
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1- Introduction

Since 1966, publications on the academic integrity of university students were introduced by Harp & Taietz in an article entitled "*Academic integrity and social structure: A study of cheating among college students*" [1] and continue to develop into a popular research agenda in various disciplines and areas of practice to the present day [2, 3]. Academic integrity is a comprehensive phrase defined as a set of values and ethics regarding one's work and academic judgment, including honesty, fairness, rigor, trust, and respect [4] in all aspects of teaching practice, research, and service [5]. Academic integrity has implications for university development [6], such as individual and institutional reputation [7, 8], producing graduates with quality and integrity [9], and maintaining organizational values education [10]. Important academic integrity is promoted and reaffirmed through international and national initiatives, institutional policies, and practices [11]. At a broader level, understanding the basic values of academic integrity espoused in a community—helping one to behave accordingly—embeds a common framework for professional work and clarifies values in the acquisition of knowledge and skills [12].

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Academic integrity is believed to be a core value for learning, teaching, and all academic activities at universities [13] because it is the moral code of an academic [14]. Maintaining academic integrity is a serious problem that often occurs in universities so far [15]. Bayaa Martin Saana et al. [16] once reported that around 40% of students had witnessed their peers engaging in academic cheating before, but the majority (94%) had never reported such acts. Moreover, according to the results of the study by Zhao et al. [17], peer cheating was one of the most vital factors associated with student academic cheating. Winardi et al. [18] also found that 77.5% of students committed to academic dishonesty. The percentage is high, and if this condition is not immediately changed with a comprehensive and contextual prevention and evaluation approach, then the problem of academic integrity will reduce the value of originality to advance knowledge and create future generations of scientists with integrity [10] and has the potential to be an indicator of student unprofessional behavior in the future in their work [14]. This justification is substantial because students with academic integrity problems have a 70.4% chance of committing the same fraud in the future [19]. The data above confirms that the problem of academic integrity is not only related to students, but peers have a strategic and crucial role in provoking problems and restoring students' academic integrity at universities.

Academic integrity problems must be diagnosed carefully through credible instruments so that lecturers can design learning environments that promote increased academic integrity. It is the background to which researchers worldwide continue to construct valid, reliable, and practical academic integrity instruments to systematically measure, evaluate, and address various student violations [20–22]. At least in the last five years, five student academic integrity instruments have been successfully developed. The development of these instruments is grouped into two main themes: first, based on forms of deviation, such as copying and collusion, cheating and complying, plagiarism, falsification, and lying about academic assignments [20–24], and second, based on indicators such as honesty, fairness, respect, trust, and responsibility [25]. Of the two instrument development themes above, the second theme better accommodates the philosophical view of academic integrity because academic integrity includes principles, norms, and regulatory frameworks that are vital for encouraging appropriate behavior in various areas of individual life [26]. Unfortunately, the formulation of instrument items developed by Ramdani [25] is still general, including "*I am happy to pass the course material to my friend*," "*I am active to participate in academic activities inside and outside of the campus*," and "*Getting a scholarship is like having a responsibility to serve the nation*." Apart from that, there are still 23.5% item loading factor values <0.50, and they have not accommodated courage as a new supplement in developing the academic integrity scale.

Academic integrity ensures accountability and responsibility for one's actions, encourages self-autonomy, and recognizes the achievements of other individuals. It implies that students with integrity must be able to support their duties under various supervisions [27, 28]. Therefore, to expand the comprehensive development of students' academic integrity, they need to be trained in integrity experiences through peer-assessment (in addition to assessing themselves). Peer-assessment has been used as one of the basic practices of class-based assessment [29], which serves to evaluate student learning progress in knowledge, attitudes, and skills [30]. Although peer-assessment has been reported to play an important role in student academic cheating [17], at the same time, peer-assessment has also been promoted in learning [31–33] as an option to train students' academic integrity by considering implementation and evaluation strategies [34–36]. When using peer-assessment, students can practice their academic integrity in two ways: power and emotion. The innovation of the peer-assessment academic integrity scale is needed to enable students to control and operationalize their power and emotions constructively when monitoring and evaluating the academic performance of their colleagues.

There are two novelty values noted in this research. First, this research fills the academic integrity scale development gap by offering a peer-assessment-oriented construct. No literature studies and empirical studies have developed numerous peer-assessments in higher education [37–40]. Unfortunately, researchers have not explicitly developed a peer-assessment-based scale to measure, assess, and evaluate students' academic integrity development. Second, this research complements the instrument development that Ramdani [25] has published by integrating indicators of courage in constructing a new academic integrity scale. Academic integrity requires a commitment to the basic values of honesty, trust, fairness, respect, responsibility, and courage [6, 8, 41]. It means that the instruments that the authors have previously developed have not yet integrated the newest indicator of academic integrity, namely courage. In fact, various integrity issues have not been resolved due to the emergence of students' fear when evaluating their performance or that of their colleagues due to various interests (internal and external).

Therefore, this study aims to develop an academic integrity scale to help lecturers evaluate the academic integrity of university students through peer-assessment learning experiences.

2- Methods

Innovation on the peer-assessment academic integrity scale used the Analyze, Design, Develop, Implement, and Evaluate (ADDIE) research and development method [42] (Figure 1).

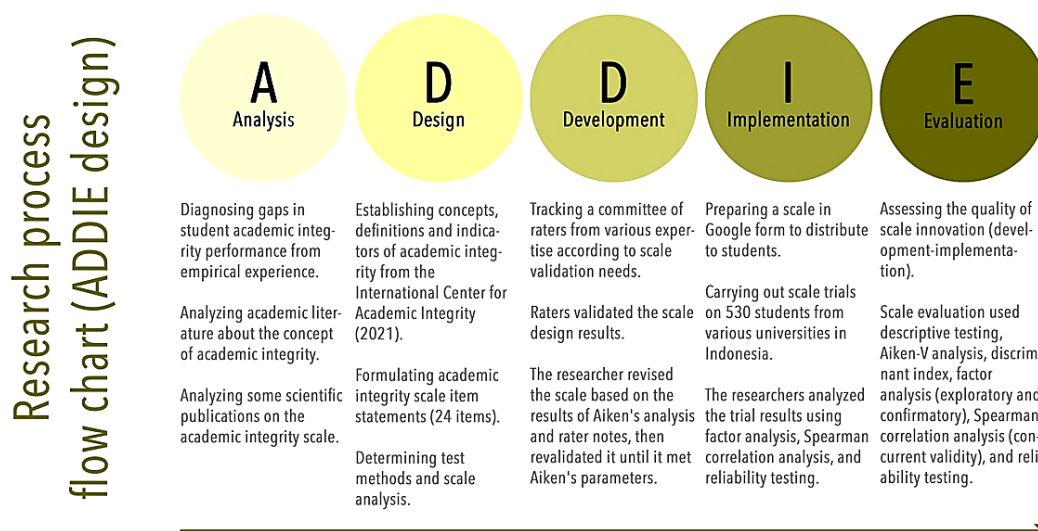


Figure 1. Research process flowchart

In the initial stage (analysis), the researcher diagnosed various opportunities for performance gaps. It can be done through a literature review and students' empirical needs for academic integrity. This analysis is based on the need to assess student academic integrity by contextualizing peer-assessment to support university students' academic performance during learning activities. The researcher tracked various publication results on the development of an academic integrity scale that is relevant to learning practices from within and outside the country, including the basic concept of its development, scale indicators, and the number of items, and then reduced it to fill the gaps in the development of the latest student academic integrity scale.

Both designs are a follow-up to the results of the previous needs analysis. The researcher designed a student academic integrity scale, including the indicators, the number of items, and the type of scale. The concept and indicators of academic integrity were adopted from the International Centre for Academic Integrity [41] by adding a new indicator (courage) to complement the previous indicators (both honesty and responsibility).

The indicators and descriptions of academic integrity are as follows: 1) Honesty (honesty forms the basis of integrity, which is more necessary and is a prerequisite for the full realization of trust, fairness, respect, and responsibility); 2) Trust (the ability to rely on the truth of someone or something is a fundamental pillar of academic teaching and a necessary foundation for academic performance); 3) Fairness (all academic community members have the right to expect fair treatment and the obligation to treat others fairly); 4) Respect (self-respect means overcoming challenges without sacrificing one's values. Respecting others means respecting the diversity of opinions and respecting the need to challenge, test, and refine ideas); 5) Responsibility (every member of the academic community is responsible to themselves and each other to maintain academic integrity. Being responsible means fighting misbehavior, negative things, or pressure from peers and being a positive example); 6) Courage (courage is different from other values because it is more of a quality or capacity of character. Courage is the ability to act following one's values despite fear).

This scale accommodates four items for each of the six indicators, so there are 24 statements with 5 Likert scales (strongly disagree-strongly agree). While the forms of analysis used are descriptive analysis, Aiken-V, discriminant index, factor analysis (exploratory and confirmatory), correlation analysis, and reliability testing.

Third, develop, generate, and validate the academic integrity scale. At this stage, the product (scale) has been developed through a validation process from an expert panelist (rater). Researchers used six raters (age = 41.2 ± 11.2 ; work experience = 17 ± 12.4) who were tracked using the Google Scholar platform by considering publication experience. Researchers recorded rater correspondence (email) to facilitate the accessibility of the validation process through paper publication. Raters come from various expertise backgrounds, such as psychometrics, educational psychology, sports psychology, counseling, and physical education (see Table 1). The scale design is circulated using the Google form to the rater's email during validation. If the scale does not meet the parameters, the researcher continues to make revisions, and the rater revalidates it until it meets the test parameters.

Fourth implementation, which is preparing university students to conduct trials of scale innovation results (after passing expert validation results) by dividing the scale through the Google form. There were 520 students involved, 48.1% male and 51.9% female (age $M \pm SD = 20.8 \pm 1.95$). Each semester I was 17.7%, semester III was 22.7%, semester V was 27.9%, and semester VII was 26%. Semester IX was 5.8%, which was spread from various universities in Indonesia, such as Universitas Kristen Artha Wacana, Universitas Nusa Cendana, Universitas Muslim Maros, Universitas Sebelas Maret, Universitas Negeri Jakarta, Universitas Buana Perjuangan, Universitas Kuningan, Universitas Majalengka, Universitas Siliwangi, Universitas Negeri Padang, Universitas Muhammadiyah Muara Bungo, Universitas PGRI Sumatera Barat, and many more.

Table 1. Rater committee

No.	Education	Gender	Expertise	Affiliation
1	S.Psi., M.Si.	Male	Psychometrics	Universitas Pembangunan Jaya, Tangerang, Indonesia
2	S.Psi., M.A.	Male	Psychology of education	Universitas Muhammadiyah Kalimantan Timur, Samarinda, Indonesia
3	Dr., S.Pd., M.Pd.	Female	Sports psychology	Universitas PGRI Jombang, Jombang, Indonesia
4	Dr., S.Pd., M.Pd.	Female	Counseling	Universitas Ahmad Dahlan, Yogyakarta, Indonesia
5	Dr., S.Pd., M.Pd., Kons.	Female	Counseling	Universitas Negeri Padang, Padang, Indonesia
6	Dr., Drs., M.Kes.	Male	Physical education	Universitas Nusa Cendana, Kupang, Indonesia

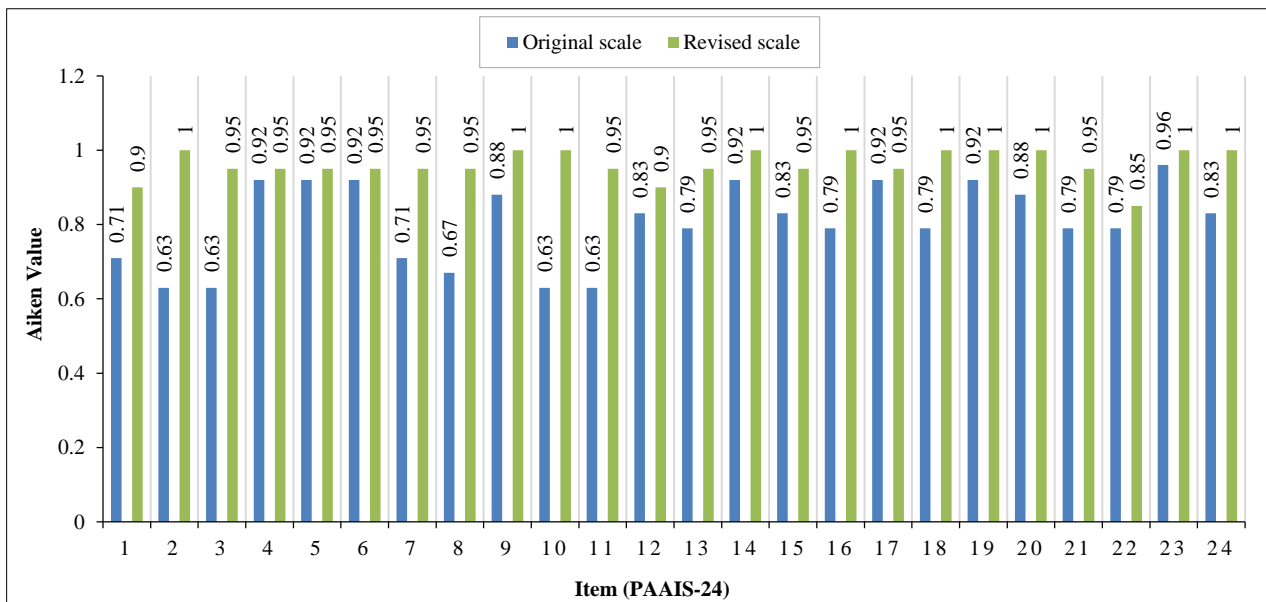
Lastly, evaluated or assessed the quality of scale innovation, both in the development and implementation stages. Evaluation includes determining evaluation criteria, selecting evaluation tools, and conducting evaluations. Scale evaluation was based on descriptive testing, Aiken-V analysis, factor analysis (exploratory and confirmatory), Spearman's correlation analysis (concurrent validity), and reliability testing.

Used descriptive analysis to evaluate the scale's summary, mean, and standard deviation. Content validity was tested using the Aiken-V formula [43], while the acceptance criteria for the Item Discrimination Index (DI) were >0.30 [44-46]. Factor analysis used the criteria for loading factor >0.30 [47-49] and the model fit or Goodness of fit based on Chi-Square (χ^2), p-value, Root mean square residual (RMR), Goodness of fit index (GFI), Tucker Lewis Index (TLI), Comparative fit index (CFI), and Root mean square error of approximation (RMSEA) [50]. Then, test concurrent validity by correlating PAAIS-24 data with the Academic Integrity Scale (AIS) developed by Ramdani [25]. Scale reliability test using Cronbach alpha with an acceptance level of >0.70 [50].

3- Results and Discussion

3-1-Results

The validation results of six raters (5 number rating categories) proved that each rater gave a mean value of >3.13 for 24 items. In detail, rater 1 = 3.13 ± 1.33 , rater 2 = 4.00 ± 1.77 , rater 3 = 4.88 ± 0.45 , rater 4 = 4.00 ± 0.00 , rater 5 = 4.63 ± 0.49 , and rater 6 = 4.63 ± 0.71 . Although all raters gave a mean >3.13 , the validation results proved that seven items did not meet the Aiken parameter (<0.79), namely items 1 (0.71), 2 (0.63), and 3 (0.63) (honesty indicator), item 7 (0.71) and 8 (0.67) (trust indicator), and items 10 (0.63) and 11 (0.63) (fairness indicator) (see Figure 2). Referring to the results of the previous test, the items that did not meet the Aiken parameters were revised for revalidation.

**Figure 2. Aiken-V analysis result**

There are several notes that the rater committee underlined in the first stage of validation. For example, in item 1, the rater recommends "Adding the word colleague." "What does the lecturer mean here? Lecturers as colleagues (colleagues), lecturers who teach us, or what? The terms lecturer and colleagues in one sentence look ambiguous." "The word can before helping is omitted because there are too many conjunctions." "The lecturer's trust in me in assessing my colleagues' academic performance helps me increase academic objectivity." Furthermore, in item 2, the rater gives a

note, "Need to be separated between "lecturer" and "colleague," because it can cause confusion when filling it out (do these two conditions - lecturers and colleagues - have to be fulfilled?)." "What kind of fair behavior needs to be made more operationally so that the respondent can imagine the form of his behavior? For example, giving grades without discriminating between students." "The subject is a lecturer or colleague; choose one so it does not have a double meaning." "The use of the word *dan* by lecturers and colleagues can raise doubts about its meaning; it is better to focus on one subject for each item."

In item 3, the rater still focuses on the subject, as stated in the following notes, "Does it need to be clarified whether asking what has been done (past) or in the future? If it is the future, it can be changed to "I will carry out..." "How can getting respect be made more specific? "The subject is a lecturer or colleague; choose one so it does not have a double meaning." "The subject is good; it is clear whose focus it is?" In item 7, the rater notes, "I am proud... it does not seem suitable for measuring trust. It should be changed according to trust indicators. "Honesty is an indicator of items 1-4, right?" "The word "proud" can have a negative connotation." Notes on item 8, for example, "Can the analytical term be parsed more clearly so as not to be biased." "It should be changed according to indicators of trust." "Honesty is an indicator of items 1-4, right?" Item 10 has two important rater notes, namely first, "Not suitable for measuring fairness --> "I am fair...", replaced for example, "I can be fair in carrying out peer-assessments." Second, "the term using abilities seems inappropriate." In item 11, the rater's notes include "Critical words just deleted." "It is better just to choose one instrument or rubric for one item, but if it is rubric, makes sure the respondent understands the meaning." "Are critical and objective indicators of justice?"

Continuing on item 21, the rater notes include "Ambiguous, to measure "responsibility" or "courage." Item 22 gets notes "Not suitable for measuring courage --> "I dare ... to help him ..." and "No need to add "it" to the word help." The rater's last notes on item 24 included "Not suitable for measuring courage" and "Does it show an indicator of courage?"

The rater's notes on the initial design of the scale above were then reviewed, reduced, and revised (see Table 2) by paying attention to the concept of indicators to maintain substance in applying peer-assessment to measure academic integrity when improving student academic performance. The revised scale is then circulated back to the rater via email to enter the revalidation stage.

Table 2. Revision of the scale after testing the validity of Aiken

No	Original scale	Revised scale
1	The lecturer's trust in me to assess the academic performance of colleagues can help me improve academic honesty.	The lecturer's trust in me to assess the academic performance of my colleagues helps me improve my academic honesty.
2	Lecturers and colleagues who behave fairly inspire me to be honest when conducting peer-assessments.	Lecturers who behave fairly when assessing my academic performance inspire me to be honest when conducting peer-assessments.
3	I conduct peer-assessments honestly because I always get the respect of lecturers and colleagues.	I carry out peer-assessments honestly because lecturers always appreciate my every achievement.
4	Honest students are more responsible in carrying out peer-assessments.	Students who tend to be honest are more responsible for peer-assessments.
5	Colleagues trust me to assess because I can provide the correct data and information.	Colleagues trust me to assess because it can provide objective information.
6	Conducting peer-assessments honestly, fairly, objectively, and responsibly can help colleagues improve their academic performance	Peer-assessments conducted using objective information can help peers improve their academic performance.
7	I am proud when assessing the academic performance of colleagues honestly, fairly, objectively, and responsibly	Peer-assessment using the instrument has more reliable results.
8	Students who think analytically and critically are more honest in carrying out peer-assessments	Students who think critically can be trusted to carry out peer-assessments
9	Peer appraisal trains me to behave fairly during lectures.	Peer appraisal trains me to behave fairly during lectures.
10	I use my abilities fairly when carrying out peer-assessments.	I can be fair in carrying out peer-assessments.
11	I use grading instruments and rubrics to critically and objectively assess colleagues' academic performance.	I use the instrument to assess the academic performance of colleagues objectively.
12	Group discussions provide an opportunity for me to express opinions and clarify the results of peer-assessments of my academic performance.	Group discussions became an opportunity for me to clarify the results of peer-assessments of my academic performance.
13	I value my ability to avoid cheating when conducting peer-assessments	I avoid cheating when conducting peer appraisals out of respect for the values I live by.
14	I improved my academic performance after getting peer-reviewed results	I improved my academic performance after getting peer-reviewed results.
15	I appreciate the results of the lecturer's assessment or peer's assessment of my academic performance, even though it is not as expected	I respect the results of peer-assessment of my academic performance, even if it does not meet expectations.
16	I discuss with lecturers and colleagues if there are differences of opinion in carrying out peer-assessments	I discuss with lecturers and colleagues if there are differences of opinion in carrying out peer-assessments.

17	Peer-assessment helps me take more responsibility for improving student academic performance	I am willing to accept the consequences of the results of the peer-assessment that I carry out.
18	I am responsible for studying the assessment instruments and rubrics prior to conducting a peer-assessment	I am responsible for studying the assessment instrument prior to conducting a peer-assessment.
19	I am responsible for supporting colleagues to improve their academic performance through peer review	I am responsible for supporting colleagues to improve their academic performance through peer review.
20	I am responsible for providing correct information to colleagues who ask questions during group discussions.	I am responsible for providing correct information to colleagues who ask questions during group discussions.
21	I dare to take responsibility for the results of peer-assessment, even though I have the chance to get rejection from colleagues.	I consistently defend the results of peer-assessments that are considered correct, even though I have the chance to get rejection by colleagues.
22	I dare to assess a colleague's academic performance critically and objectively to help him improve his academic performance.	I firmly refuse to increase my friend's score when carrying out peer-assessments so that he is careful in identifying problems with his academic performance.
23	I dare to express an opinion that I believe to be true, even though it differs from my colleagues' assessment results.	I dare convey the results of a colleague's assessment, which I believe to be accurate, even if the opinion differs from mine.
24	I support honest, objective, fair, and responsible peer-assessment decisions to improve student academic performance.	I am committed to supporting objective peer-review decisions to improve student academic performance.

When revalidating, the Aiken parameters used differ from before (original version). The reason was that one rater did not revalidate according to the specified time limit. Thus, only five raters were revalidated, so the Aiken parameter used was 0.80. The results of the rater revalidation proved that each rater gave a mean value of >4.79 for the item revision results. In detail, rater 1 = 4.83 ± 0.38 , rater 2 = 4.92 ± 0.28 , rater 3 = 4.92 ± 0.28 , rater 4 = 4.78 ± 0.41 , rater 5 = 4.79 ± 0.41 . Positive results were also obtained from Aiken's analysis, in which 24 items passed the passing grade parameter Aiken (>0.80), with the lowest score on item 25 (0.85) and the highest score on items 2, 9, 10, 14, 16, 18, 19, 20, 23, and 24 (1.00) (see Figure 2).

After passing through the development stage, the scale was implemented (field trial) to 520 participants to test the construct validity. First of all, the academic integrity scale goes through item discriminant analysis (DI) to measure item quality [51] to explain how well an item can distinguish between participants with high abilities and participants with low abilities [44, 52]. DI is also the result of how participants interpret what questions or statements are being tested or how editorial each question or statement is [53]. The results of the DI analysis using the Pearson correlation (corrected item-total correlation) prove that all items function correctly (see Table 4) because they have a value range of 0.533-0.777 (>0.30) [44–46].

Exploratory Factor Analysis (EFA) was tested based on each construct to check the inter-correlations between all variables in the scale and then reduce the data to a smaller number of dimensions (factors) [54]. The rationale is, at the beginning of developing the scale, items have been constructed based on an initial analysis of certain theoretical concepts [55], such as the construct of academic integrity developed based on the concept of the International Centre for Academic Integrity [41]. The test results prove that all constructs meet the criteria for the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (>0.50 ; sig. = <0.05) [48, 56–58]. Thus, the suitability of the sample size data meets the criteria for undergoing factor analysis (see Table 3).

Table 3. Kaiser–Meyer–Olkin and Bartlett's test

KMO and Bartlett's test		Honesty	Trust	Fairness	Respect	Responsibility	Courage
KMO Measure of Sampling Adequacy		0.765	0.781	0.800	0.767	0.813	0.797
Approx. Chi-Square		455.292	630.397	826.952	572.874	865.966	670.228
Bartlett's Test of Sphericity	df	6	6	6	6	6	6
	Sig.	0.000	0.000	0.000	0.000	.000	0.000

The anti-image correlation values for the honesty construct ranged from 0.75 to 0.79, and communalities values ranged from 0.519 to 0.627. The value of the trust construct ranges from 0.75 to 0.84, and the value of communalities ranges from 0.505 to 0.690. The fairness construct values ranged from 0.78 to 0.82, and the communalities values ranged from 0.649 to 0.721. The respect construct values ranged from 0.72 to 0.82, and the communalities values ranged from 0.516 to 0.711. The value of the responsibility construct ranges from 0.77 to 0.84, and the value of communalities ranges from 0.652 to 0.762. Finally, the values of the constructs of courage ranged from 0.78 to 0.84, and the values of communalities ranged from 0.547 to 0.677. It was concluded that the anti-image correlation and communalities values met the criteria of >0.50 , so all items in each construct were feasible and could explain each factor (see Figure 3).

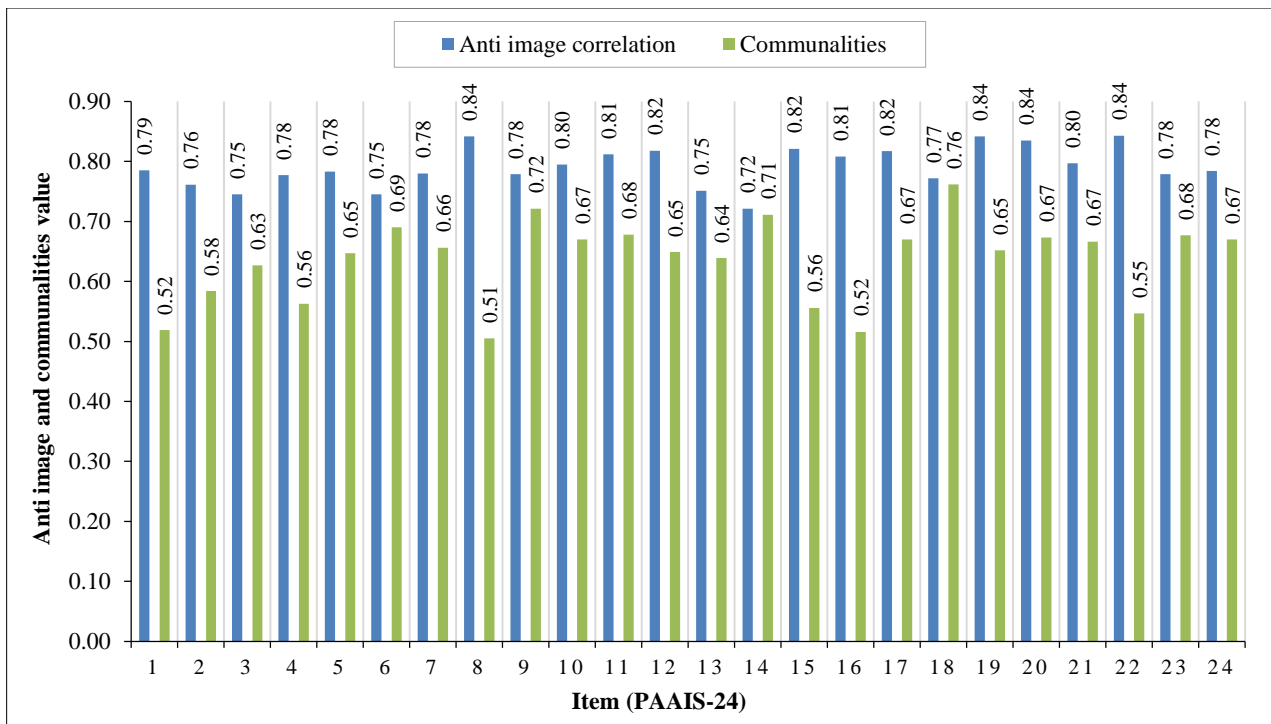


Figure 3. Anti image correlation and communalities

As explained at the beginning of the EFA analysis, where the analysis is carried out for each construct, each construct only explains 1 factor with the extraction method using the Principal Component Analysis. In detail, the honesty construct explains a total variance of 57.324%, the trust construct explains a total variance of 62.464%, the fairness construct explains a total variance of 67.928%, the respect construct explains the total variance explained by 60.534%, the responsibility construct explains the total variance explained by 68.942%, and the courage construct explains the total variance explained by 63.996%.

Furthermore, the component matrix values for each construct item ranged from 0.720-0.792 for items 1-4 (honesty factor), 0.711-0.831 for items 5-8 (trust factor), 0.805-0.849 for items 9-12 (fairness factor), 0.718 -0.843 for items 13-16 (factor respect), 0.808-0.873 for items 17-20 (factor of responsibility), and 0.740-0.823 for items 21-24 (factor of courage). That is, all component matrix values >0.70 (see Table 4) so that PAAIS-24 meets the parameters of factor analysis [47–49].

Table 4. Mean, standard deviation, discriminant index, EFA loading factor, and CFA loading factor

Item	M \pm SD	DI	λ (EFA)	λ (CFA)	Item	M \pm SD	DI	λ (EFA)	λ (CFA)
1	4.01 \pm .68	0.667	0.720	0.691	13	4.20 \pm .64	0.665	0.799	0.682
2	4.26 \pm .57	0.533	0.764	0.599	14	4.10 \pm .59	0.753	0.843	0.775
3	4.18 \pm .61	.608	0.792	0.668	15	3.98 \pm .72	0.641	0.746	0.614
4	4.19 \pm .64	0.599	0.751	0.650	16	4.15 \pm .62	0.682	0.718	0.686
5	3.95 \pm .70	0.669	0.804	0.708	17	4.04 \pm .63	0.732	0.819	0.755
6	4.05 \pm .58	0.703	0.831	0.755	18	4.08 \pm .57	0.777	.873	0.810
7	3.99 \pm .64	0.720	0.810	0.756	19	4.04 \pm .64	0.712	0.808	0.725
8	4.99 \pm .78	0.627	0.711	0.615	20	4.12 \pm .61	0.760	0.820	0.776
9	4.13 \pm .63	0.742	0.849	0.773	21	4.00 \pm .63	0.705	0.816	0.744
10	4.15 \pm .56	0.729	0.818	0.755	22	3.95 \pm .76	0.568	0.740	0.585
11	4.01 \pm .65	0.733	0.824	0.754	23	3.99 \pm .67	0.685	0.823	0.724
12	4.11 \pm .66	0.722	0.805	0.747	24	4.10 \pm .63	0.774	0.818	0.806

The structure of each EFA factor then passes the Confirmatory Factor Analysis (CFA) test. CFA is a powerful statistic for examining properties and relationships between latent constructs (e.g., attitudes, traits, intelligence, clinical disorders). CFA tests a priori hypotheses or verifies the factor structure of a set of observed variables or latent variables [59–61] by detecting relevant and irrelevant items while extracting valuable factors from the data set [62]. The CFA test results prove that each PAAIS-24 item meets the validity parameter because the factor loading value (λ) >0.30 [47–49].

The PAAIS-24 construction also proved to fulfill the goodness of fit parameters. This decision is based on the results of testing the fit model with CFA using the SPSS-AMOS program showing a value $\chi^2 = 593.286$, $df = 237$, $p\text{-value} = 0.000$ (<0.05), $GFI = 0.913$ (>0.90), $RMSEA = 0.054$ (<0.08), $RMR = 0.015$ (<0.08), $CFI = 0.916$ (>0.90), $TLI = 0.916$ (>0.90), $NFI = 0.916$ (>0.90).

After PAAIS-24 meets the content and construct validity parameters, the next step is to test its concurrent validity. Concurrent validity is generally interpreted as the correlation between the test and the relevant criteria [63, 64], indicating the amount of agreement between newly developed instruments and established instruments [65] or assessing as how well a measure correlates with other measures at the same measurement point [66]. Before testing the concurrent validity, the data passed the normality test using the Kolmogorov-Smirnov test and the linearity test using the ANOVA table. As a result, the data were not normally distributed ($sig. = 0.000 < 0.05$), and the data also did not have a significant linear relationship between PAAIS-24 and AIS ($sig. = 0.000 < 0.05$). Hence, the correlation test used was nonparametric statistics (Spearman correlation).

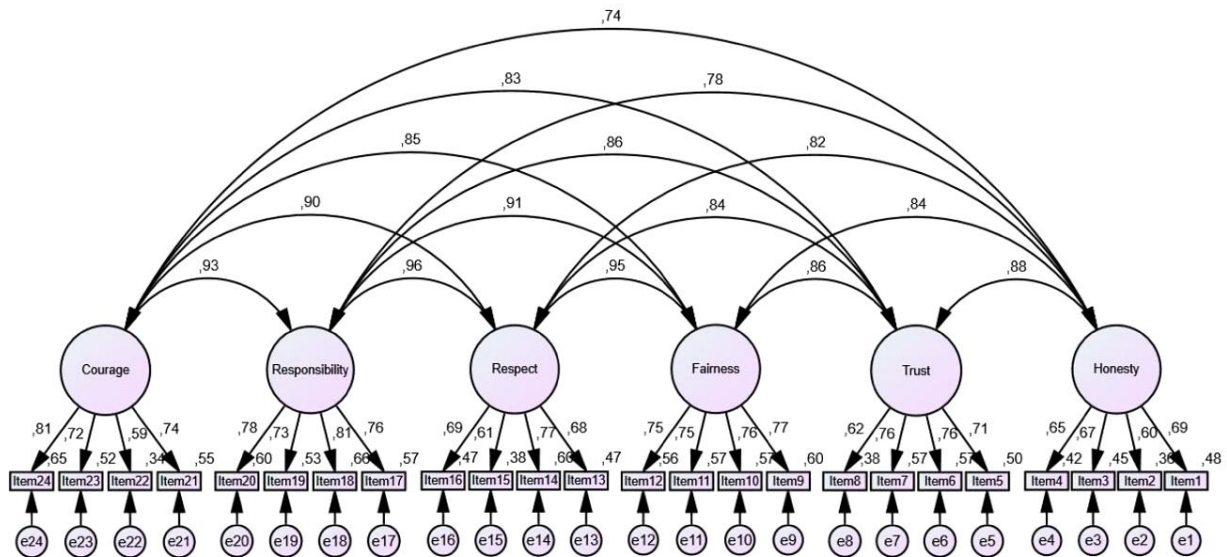


Figure 4. Diagram path

Concurrent validity was carried out by correlating between PAAIS-24 and AIS. AIS uses the same indicators as PAAIS-24 but is not equipped with a courage indicator. In addition, the development of AIS contains statements that are more oriented toward "self-assessment." For example, the items "Honesty trains us to believe in our abilities," "For me, preparing the material before the lecture is a natural thing," "Regular academic evaluation is very important in the learning process," and "I feel a good image of campus is a shared responsibility." Meanwhile, PAAIS-24 contains statements oriented towards "peer-assessment" to support improving student academic performance.

Table 5. Concurrent validity (intercorrelation PAAIS-24 with AIS)

PAAIS-24	Academic Integrity Scale					
	Honesty	Trust	Fairness	Respect	Responsibility	Total
Honesty	0.413**	0.441**	0.387**	0.404**	0.417**	0.470**
Trust	0.394**	0.520**	0.514**	0.424**	0.373**	0.498**
Fairness	0.474**	0.576**	0.559**	0.476**	0.443**	0.578**
Respect	0.481**	0.559**	0.534**	0.489**	0.455**	0.581**
Responsibility	0.454**	0.566**	0.542**	0.484**	0.447**	0.578**
Courage	0.421**	0.500**	0.543**	0.467**	0.389**	0.531**
Total	0.467**	0.595**	0.584**	0.497**	0.466**	0.579**

** Correlation is significant at the 0.01 level (2-tailed).

Spearman's output proves a total correlation value of 0.597 ($sig. = 0.000$), so there is a significant correlation between PAAIS-24 and AIS. A similar decision also applies to the intercorrelation results of the indicators of the two scales. Referring to the test results above, the total correlation of the two instruments is in the moderate category (0.40-0.69) [67, 68].

After passing the three validity tests (content, construct, and concurrent), PAAIS-24 must also pass reliability tests to determine internal consistency [69]. As a result, the total internal reliability coefficient of Cronbach's alpha is 0.95, which means there is a 95% certainty of item consistency in displaying the same results repeatedly. The reliability of each indicator is as follows: honesty ($\alpha = 0.748$), trust ($\alpha = 0.789$), fairness ($\alpha = 0.841$), respect ($\alpha = 0.777$), responsibility ($\alpha = 0.848$), and courage ($\alpha = 0.807$). In addition, the breakdown per item, coefficient $0.947 = 16.67\%$ (items 14, 18, 20, and 24), coefficient $0.948 = 45.83\%$ (items 6, 7, 9, 10, 11, 12, 16, 17, 19, 21, and 23), coefficient $0.949 = 29.17\%$ (items 1, 3, 4, 5, 8, 13, and 15), and coefficient $0.950 = 8.33\%$ (items 2 and 22). Thus, the reliability coefficient is classified as somewhat high (0.90 to <0.95) [50]. The PAAIS-24 has proven to be a reliable measure of academic integrity when conducting peer-assessments to improve academic performance.

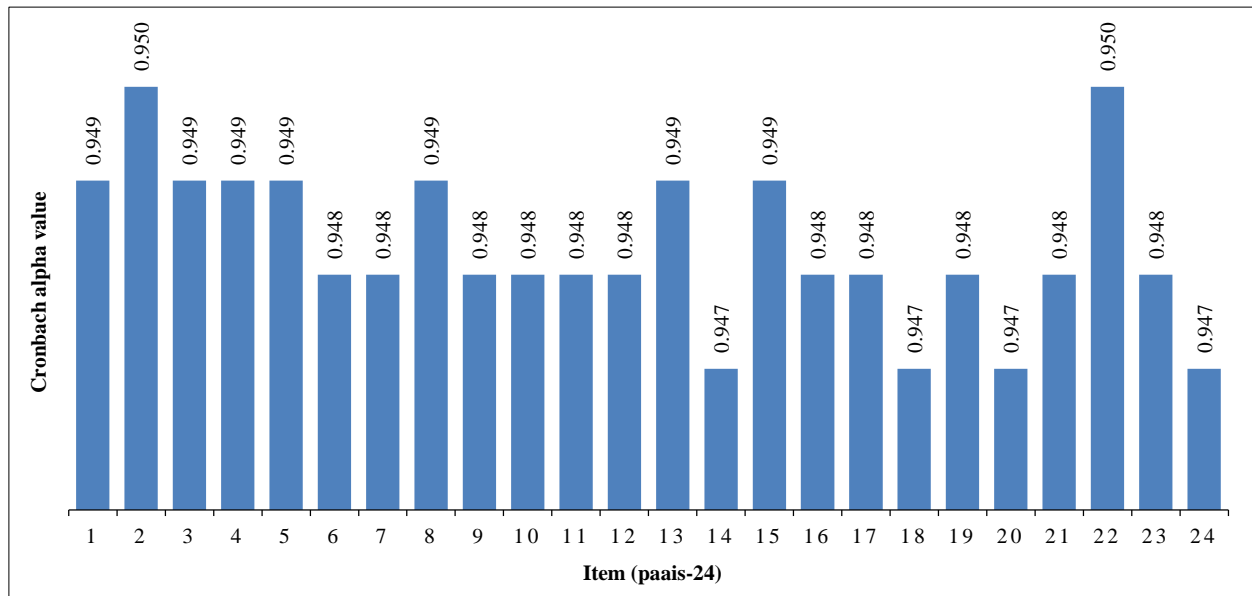


Figure 5. Reliability test

3-2-Discussion

This research aims to develop an academic integrity scale to help lecturers assess and evaluate the academic integrity of university students through peer-assessment experiences. The instrument developed has undergone validity and reliability tests to see whether it can predict the level of measurement error accurately and based on the research objectives [70]. This research has three stages of validity testing and one stage of reliability testing. After one revision, the validity of the content using Aiken parameters has been accepted. When testing construct validity, the DI value was >0.50 (0.533-0.777), so all items functioned well in explaining participants with high abilities and participants with low abilities. Likewise, the EFA and CFA loading factor values >0.50 (EFA = 0.711-0.873; CFA = 0.585-0.810), so there is a high correlation between items and artificial factors or variables made in factor analysis. In testing the fit model using SPSS-AMOS, it proved that the value of $\chi^2 = 593.286$, $df = 237$, $p\text{-value} = 0.000$ (<0.05), $GFI = 0.913$ (>0.90), $RMSEA = 0.054$ (<0.08), $RMR = 0.015$ (<0.08), $CFI = 0.916$ (>0.90), $TLI = 0.916$ (>0.90), $NFI = 0.916$ (>0.90). As a result, it can be concluded that the model is fit because the theoretical model of PAAIS-24 is in accordance with the empirical data (most model test values were >0.90). Whereas in reliability testing, PAAIS-24 also met the criteria with a Cronbach's alpha value range of 0.95 (0.947-0.950).

This research differs from the Cross-Cultural Academic Integrity research developed by Henning et al. (2016) and (2020) [20, 21]. Cross-Cultural Academic Integrity developed three indicators based on forms of academic integrity violations, such as (1) copying and collusion, (2) Cheating, (3) Complying, so that the more philosophical indicators of academic integrity have not been maximally verified, including the courage that we have used in this research. Furthermore, when compared with Bashir and Bala's research in 2018 [23] and Özmercan et al.'s research in 2022 [24], they focused more on developing instruments to measure academic dishonesty. Both studies have to narrow a scope to measure academic integrity. Meanwhile, research conducted by Ramdani [25] has used 5 (five) indicators, namely (1) Honesty, (2) Fairness, (3) Respect, (4) Trust, (5) Responsibility. This research is basically good enough to reveal the scale of academic integrity, but it still does not accommodate the expression of courage. According to Amrane-Cooper et al. [71], academic integrity is a dedication to core principles, such as courage, even in the face of adversity. As such, this research is an improvement on previously available methods for measuring academic integrity.

PAAIS-24 does not have a loading factor value <0.50 , as found in previous research (23.5%). The factor analysis results prove that the PAAIS-24 loading factor value is >0.50 , with a higher reliability value than previous research

(0.95 > 0.87). Another fundamental difference is that the formulation of the items is specifically designed to project students' academic integrity experiences in conducting peer-assessments. In addition, this new research formula promotes a peer-assessment-oriented academic integrity testing approach in each item formulation [31–36] and complements encouragement as the latest indicator in measuring, assessing, and evaluating student academic integrity. The primary difference is the addition of encouraging factors in the construction of PAAIS-24 items, as has been recommended as an essential principle in training one's academic integrity [72–76]. Considering that in the latest learning trends, students are given more autonomy to develop their potential through peer-assessment, peer-assessment experiences can ideally shape students' academic integrity behavior while acting boldly to promote various proactive behaviors that support the development of peers' academic performance.

According to San Jose [28], people with integrity have self-accountability and self-autonomy and also recognize the achievements of others, so individuals with integrity must be able to carry out supervisory duties credibly. This condition can be confirmed in learning activities through peer-assessment. Peer-assessment has been used as one of the assessment practices at universities [29, 37–40] so that it can be optimized to train students to measure, assess, and evaluate the achievement and progress of other individual learning in an objective, accountable, and credible manner [30]. To ensure that these efforts have high implications, student experiences through peer-assessment must also be evaluated using credible instruments not to be trapped in deviant behavior (academic dishonesty) when using their authority as assessors. Aspects that must be considered when evaluating student academic integrity include honesty, trust, fairness, respect, responsibility, and encouragement [41].

This scale differs from the previously developed integrity scale because it prioritizes peer-assessment to improve academic performance. Readers can compare it with the AIS that Ramdani [25] has developed. AIS has not yet accommodated the encouraging indicator. Not only that, AIS is still general because it has not championed the values of academic integrity to support the development of student academic performance. In fact, one of the ideal fields to train students' academic integrity is to supervise their colleagues. For example, on the responsibility indicator, AIS uses the formula *"Getting a scholarship is like having a responsibility to serve the nation"* and *"I feel a good image of campus is a shared responsibility."* Meanwhile, with the same indicator (responsibility), PAAIS-24 uses the item formulation *"I am responsible for studying the assessment instrument before conducting a peer-assessment," "I am responsible for providing correct information to colleagues who ask questions during group discussions,"* and others (see items 17–20).

Academic integrity problems often arise from monitoring people who have social and power relations. For example, during the monitoring phase, there is abuse of authority [77]. Just look at the case in the study by Ayalon & Wilkie [78], which shows that the average student needs more confidence to assess the responses of school students' assignments. Also, because of social and power relations, most students who have witnessed irregularities never report these actions [16]. Considering the previous cases, the formulation of the items in PAAIS-24 is more oriented towards the strategic role of peer-assessment to train academic integrity in promoting the development of academic performance. For example, on the courage indicator, developed item formulations such as *"I firmly refuse to increase my friend's score when carrying out peer-assessments so that he is careful in identifying problems with his academic performance," "I dare convey the results of a colleague's assessment, which I believe to be accurate, even if the opinion differs from mine,"* and *"I am committed to supporting objective peer-review decisions to improve student academic performance."* This item formulation provides added value to the development of integrity instruments. The reason is without courage, students' efforts to maintain integrity are easily refuted because they are unable to defend the truth. The purpose of peer-assessment is to help students become more significant in improving performance, so having the courage to give an objective assessment can help colleagues to be better is an integral part of maintaining self-integrity, even with criticism.

Finally, this research has also grouped categories based on scores obtained from measurements using PAAIS-24, namely: 1) <40 (very low), 2) 40 to <56 (low), 3) 56 to <72 (less), 4) 72 to <88 (moderate), 5) 88 to <104 (high), and >104 (very high).

4- Conclusion

Learning at universities has introduced many peer-assessment experiences, so the presence of PAAIS-24 supports students' learning experiences to use their authority when supervising the academic performance of their peers. If measuring academic integrity has been based more on self-assessment, the results of this research offer new value, namely that measuring academic integrity can also be measured using a peer-assessment-based approach. PAAIS-24 was developed using the six latest academic integrity indicators: honesty, trust, fairness, respect, responsibility, and courage. It is proven to have an anti-image correlation value and a communalities value that meets the criteria because it is >0.50. Each factor explains the total variance of 57.324% (honesty), 57.324% (trust), 67.928% (fairness), 60.534% (respect), 68.942% (responsibility), and 63.996% (courage). The EFA and CFA loading factor values are >0.50, explaining the high correlation between items and artificial variables created in factor analysis. Meanwhile, for testing concurrent validity, the total correlation value is 0.597. Reliability testing also proves that there is 95% certainty (0.95) of item consistency in displaying the same results repeatedly. Thus, lecturers can use PAAIS-24 as a tool when measuring, assessing, and evaluating their students' academic integrity.

5- Declarations

5-1-Author Contributions

Conceptualization, J.B., H.S., and Y.H.; methodology, I.M.S.M.; software, S.H.; validation, H.S., Y.H., and A.M.; formal analysis, J.B. and I.M.S.M.; investigation, S.H.; resources, J.B.; data curation, Y.H.; writing—original draft preparation, S.H.; writing—review and editing, J.B. and A.M.; visualization, J.B.; supervision, Y.H. and A.M.; project administration, J.B.; funding acquisition, S.H. All authors have read and agreed to the published version of the manuscript.

5-2-Data Availability Statement

The data presented in this study are available on request from the corresponding author.

5-3-Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

5-4-Acknowledgements

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5-5-Institutional Review Board Statement

Not applicable.

5-6-Informed Consent Statement

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

5-7-Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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