Reliability and Validity of Instrument on Academic Enhancement Support for Student-Athlete Using Rasch Measurement Model

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Abstract: The purpose of this article is to develop and validate an instrument on Academic Enhancement Support for Malaysian student-athletes. The instrument development process began earlier in previous research's stages. Thirty-five questionnaires were distributed to Malaysia Public University student-athletes who competed at the university and state levels. It took a week to collect data, with a 100% return rate and one damaged questionnaire removed. Winstep version 3.69.1.11 was used to conduct three analyses: item-person reliability and separation index, statistical fit, and standardised residual correlation for item dependent. Cronbach's alpha of 0.96 indicates high reliability, with all items displaying a positive value for item polarity. Thirty items were identified as being misfit, five of which were removed and fifteen of which were revised. In the final analysis, ten pairs of items were dictated to be redundant, and ten items were eliminated following selection. In total, 15 items were removed from the instrument, leaving 82 items in the validated version. In conclusion, the instrument developed is a valid instrument capable of validating the student-perception athlete's of the support necessary for academic advancement during actual study.
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Keywords: Academic Enhancement, Student Support, Rasch Measurement Model, Student-athlete

1. Introduction

Student-athletes can be defined as a small population of students at each educational institution who attend classes full-time and participate actively in sports activities (Diersen, 2005). The United States Code, Title 15 (Commerce and Trade), Chapter 104 (Sports Agent Responsibility and Trust), defines a student athlete as an individual who participates in, is eligible to participate in, or may participate in any intercollegiate sport in the future. A person who is ineligible to participate in a particular intercollegiate sport on a permanent basis is not considered a student athlete for the purposes of that sport (Legal Information Institute, 2004). These definitions highlight two distinct characteristics of student-athletes, who are defined as students enrolled in an educational institution who maintain a sports commitment throughout the academic session. This dual lifestyle undoubtedly presents challenges for student-athletes who wish to excel in both. Balancing these two distinct lifestyles is not easy. Additionally, student-athletes reported having difficulty deciding on an academic major due to

their strong athletic identity, which may influence them to choose a less rigorous academic major, negatively impacting their academic and career satisfaction (Foster & Huml, 2017). This is accurate, as Bowman et al. (2020) stated in their findings that returning student-athletes face difficulties due to a lack of communication between stakeholders, athletes' anxiety about requiring accommodations, and difficulty convincing faculty to provide reasonable accommodations. The lack of support from stakeholders appears to exacerbate the difficulties faced by student-athletes.

Stakeholder support takes a variety of forms. Foster & Huml's (2017) research on the athletic department's role suggested that this particular stakeholder should guide student-athletes in their academic major selection by (i) better preparing their student-athletes to understand the career prospects of their academic major; and (ii) assisting student-athletes who have interests in more rigorous academic majors through tuition assistance. These stakeholders' roles contribute to the development of student-athletes. Nonetheless, it is critical to have an understanding of the specific support that student-athletes require, as cultural differences are likely to have a significant impact on student-athletes' identity and motivation (Quinaud et al., 2019). Providing relevant support to this student will increase their academic engagement which in turn will improve their academic performance as well (Delfino, 2019).

Thus, it is reasonable to conclude that developing a tool capable of assisting in determining the aforementioned factors is critical, if not demanding. This study is a subset of a larger project aimed at developing an academic enhancement support framework for student-athletes in Malaysian Public Universities (PU). This framework is critical for student-athletes to improve their academic achievement throughout the study. The purpose of this study was to determine the reliability and validity of an instrument that had been developed previously using a different approach. A study to determine the instrument's validity and reliability is critical to ensuring the questionnaire's accuracy (Rahayah Ariffin et al., 2010). As a result, this study used the Rasch measurement model to establish the validity and reliability of an academic enhancement support questionnaire. The objectives of this study are to: I assess the reliability and item separation index of the instrument and the respondent; ii) assess the instrument's item fit; and iii) ascertain the item's dependence on the correlation between the standardised residuals for the items and the transfer of learning

1.1 Validity and reliability

Validity and reliability are two of the criteria that contribute to the quality of the questionnaire. Validity refers to the extent to which the measure is actually measuring what intended to be measured. There are several forms of validity in assessing a questionnaire, including face validity, content validity, construct validity, statistical validity, ecological validity and internal and external validity (Leavy, 2017). Nevertheless, according to Creswell & Cresswell (2018), among these form of validity, the three forms that needed to look for are content validity, which looking at the item measuring the content they are intended to measure, predictive or concurrent validity, which looking at the scores predicting a criterion measured and do results correlate with other results and construct validity, which looking at item measuring the hypothetical constructs or concepts. Overall, validity helps the researcher to determine either the questionnaire is good for the survey research or not.

On the other hand, reliability refers to the consistency of the result. Cronbach's alpha and factor analysis are the two most common use reliability test to check the internal consistency of scales (Leavy, 2017), which measure the degree to which sets of items behave in the same way (Creswell & Cresswell, 2018). Cronbach's alpha depends on the number of items and their average intercorrelation. Therefore, a high Cronbach's alpha value may indicate high reliability. However, it also may indicate that the answers may affect each other as respondent might remember the previous answer and try to be consistent. Meanwhile, a low value may indicate low reliability, which may also be interpreted as not measuring the same constructs (Wiley, 2020).

1.2 Rasch Model Measurement

In research, a good measurement process is an important thing to produce good research results. However, a good study results in evaluating or making judgments also requires an accurate and precise measurement process. In addition to using an appropriate measuring instrument or instrument, the selection of a suitable and good measurement model must also be used to obtain good measurement

results. Thus, using the Rasch measurement model is a solution path to validity issues because the Rasch measurement model provides useful statistics and offers enormous opportunities for validity investigations (Bond & Fox, 2007). The Rasch measurement model is capable of doing the things that a measurement model needs to be capable of; (i) produce linear measurements; (ii) be able to solve the problem of lost data; (iii) can provide a budget accuracy; (iv) be able to detect misfit data or isolated data; and (v) provide separable or independent measurement instruments for parameters of an object. Several diagnoses are often used in the Rasch measurement model that aims to test and check-in determining the validity and reliability of an instrument. Among them are; (i) test the reliability and index of item and respondent segregation; (ii) detect the Polarity of the item measuring the construct; (iii) test the suitability of the item (item fit) of the instrument in the assessment instrument; (iv) determine dependent items based on standardised residual correlation values; (v) determine the level of difficulty of the item and the abilities of the respondent; (vi) detect the existence of differential item functioning (DIF) in the instrument; (vii) determine the functionality of the measurement scale category structure, and (viii) identify the unidimensionality of constructs. In addition to functioning in verifying the items and constructs of an instrument, the Rasch approach can also be used to analyse research findings such as determining differences between the two variables, level measurements, and correlations.

2. Methodology

The methodology section describes all the necessary information that is required to obtain the results of the study. It consists of Research Design, Research Procedure and Research Intrument or other important information related to methodology.

2.1 Research Instrument

The development of the instrument for this study was done in the first phase through a qualitative method. It involves twelve experts who are experienced in the management of student-athletes at Malaysia Public University. This instrument is divided into five parts, namely part A (demographics), part B (environment), part C (academic), part D (psychological-social) and part E (opinion). The structure of the instrument can be seen in Table 1. In part B, C, D, respondents must answer the items provided by making a choice based on a ranking scale. This study will focus on these parts (B, C and D) as these are the domains intended to be measured through this instrument.

Table 1. Instrument structure

Domain	Item	Total
B. Environment	B1-43	43
C. Academic	C1-41	41
D. Psychological-social	D1-13	13
Total		97

This instrument uses the Likert Scale to obtain answers from respondents. The use of ranking scales in questionnaires is appropriate for measuring respondents' perceptions. Therefore, respondents were asked to give a perception of the items based on the ranking scale. The ranking scale used is a type of five scales. This type of ranking scale did not provide ranking to the respondents in answering the questionnaire, as (Hair et al., 2017) suggested.

2.2 Research Sample

The sample for this study consisted of 35 student-athletes who were actively involved in sports activities at Malaysia Public University (PU). The selection of undergraduate student-athletes at Malaysia PU is because these individuals have the same characteristics as the study sample where they are student-athletes at PU but only compete at the university or state level. However, no respondents

involved in this pilot study were selected for the actual study. The number of respondents in this pilot study is adequate since according to Cooper and Schindler (2011), the appropriate number of respondents in the pilot study ranged from 25 to 100 people. While Johanson and Brooks (2010) suggested a minimum number of 30 people for a pilot study whose purpose is for initial study or scale development.

2.3 Data Collection

The researcher conducted a pilot study by distributing questionnaires to 35 undergraduate student-athletes at Malaysia Public University (PU). The questionnaire was distributed through email to the respondent within a week timeframe. The respondent was required to answer the questionnaire in the Google Form, and the response was recorded on the spot as the respondent submitted the form.

2.4 Data Analysis

The results of the study were analysed using Winsteps Version 3.69.1.11 software with the Rasch measurement model approach. The Rasch model approach is used because it is well suited to constructing instruments that use rating scales (Bond and Fox, 2007). The researcher examined the functionality of the items from the aspects of reliability and isolation of the respondent's items, statistical fit, and the standardised residual correlation value.

2.4.1 Reliability and Item-Respondent Isolation

To determine the reliability of the instrument, the Cronbach's Alpha score was referred. Based on the Rasch measurement model approach, the acceptable Cronbach's Alpha (α) value of its reliability is between 0.71–0.99 (best level) as in Table 2 (Bond & Fox, 2007).

Table 2. Interpretation of Cronbach's Alpha score

Cronbach's alpha score	Reliability
0.8 – 1.0	Excellent and effective with a high degree of consistency
0.7 – 0.8	Good and acceptable
0.6 – 0.7	Acceptable
<0.6	The item needs to be revised
<0.5	The item needs to be drop

2.4.2 Statistical Fit

According to Green & Frantom (2002), a fit statistic in the Rasch measurement model is an analysis that provides internal mechanisms to identify inappropriate responses to the items and allowed for exclusion or re-assessment of the responses that do not fit. To perform this analysis, three measurements were taken into consideration, which is point measure correlation (PTMEA CORR), Mean square (Outfit MNSQ) and outfit ZSTD (Azrilah et al., 2014). Checking the Point Measure Correlation (PTMEA CORR) value to detect item polarity aims to test the extent to which domain construction achieves its goal. If the value found on the PTMEA CORR section is positive (+), it indicates that the item measures the domain to be measured (Bond & Fox 2007). Conversely, if the value is negative (-), the developed item does not measure the domain you want to measure. Then it needs to be revised or dropped because the item does not lead to a question (not focused) or is difficult to answer by the respondent. The suitability of the items for measuring the developed domain can be seen through the values found on the Mean-Square outfit index (MNSQ). According to Bond and Fox (2007), MNSQ outfit values should be between 0.6 to 1.4 to ensure that the items developed are suitable for measuring domains. If the MNSQ value is more than 1.4 logit, it gives the meaning of a confusing item. If the MNSQ value is less than 0.6 logit, it indicates that the item is too easily expected by the

respondent. Therefore, if this condition is not met, the item can be considered for removal or purification. The last measurement, the outfit ZSTD value, has the fit item range between -2.0 to +2.0. The item that falls outside this range will be considered a misfit and can be dropped or revised. This is as according to (Green & Frantom, 2002), a misfit item are considered to be too complex, confusing or measuring different construct. Thus, it will influence the reliability of the instrument as a whole.

2.4.3 Standardised Residual Correlation Values in Determining Dependent Items

To determine whether there are items that overlap with other items, then the residual correlation value needs to be referenced through Item Dimensionality. The high residual correlation for the two items more than 0.7 indicates that the items are dependent (Linacre, 2005). This is because the items have similar characteristics or combine several other dimensions that are shared. Items with an MNSQ outfit value approaching 1.0 were retained in this study.

3. Results and Discussion

3.1 Results

The researcher collected data via an online survey, which took about a week to complete. 35 questionnaires were distributed to the identified respondent, and all were returned, resulting in a 100% response rate. The data was then cleaned to remove outliers and damaged questionnaires. Following that, one questionnaire was omitted due to the respondent's incomplete response. As a result, this study analysed data from 34 surveys.

3.1.1 Reliability and Separation Index Item-Person

The analysis of the study found that the reliability value obtained based on the Cronbach's Alpha (α) value was 0.96. This means that the instruments used are in excellent condition and effective with a high level of consistency and can be used in real research. Analysis of the instrument was also performed to see the reliability and isolation of the items and respondents where the value of item reliability is 0.66, while the value of item isolation is 1.50. Based on the item reliability value, a value of 0.66 indicates to be within acceptable (Bond & Fox, 2007). While the item isolation value is 1.50, which indicates all items are divided into two measurement levels. According to Linacre (2005), the value of good index isolation is more than the value of 2.0. For the respondents' analysis, the respondents' reliability value is 0.90, and the isolation value of the respondents is 3.08. This indicates that the reliability value of the respondents is very high and very good. Bond & Fox (2007) explained that reliability values above 0.8 are good and strongly accepted. Meanwhile, the isolation value of the respondents shows four levels of the respondents' ability to agree on items. Thus, a good isolation value against the item difficulty level aligns with (Linacre, 2005), who explained that an isolation value greater than 2.0 is good. Table 3 shows the statistical summary for reliability and separation index for item and person.

Table 3. Statistical summary for reliability and separation index item-person

Item	Cronbach's Alpha	Item Reliability	Item Separation	Person Reliability	Person Separation
97	0.96	0.66	1.50	0.90	3.08

On the other hand, the Wright Map produced from the analysis shows the overall picture of the distribution of person ability and item difficulty (Bond & Fox, 2015). By referring to the map, it is clear that majority of the items were below that the ability logit of the person to answer at above 1. Only three

items are above the minimum person's ability. This means that the individual can easily answer the majority of the questions. The Wright Map utilised in this study is depicted in **Fig.1.**

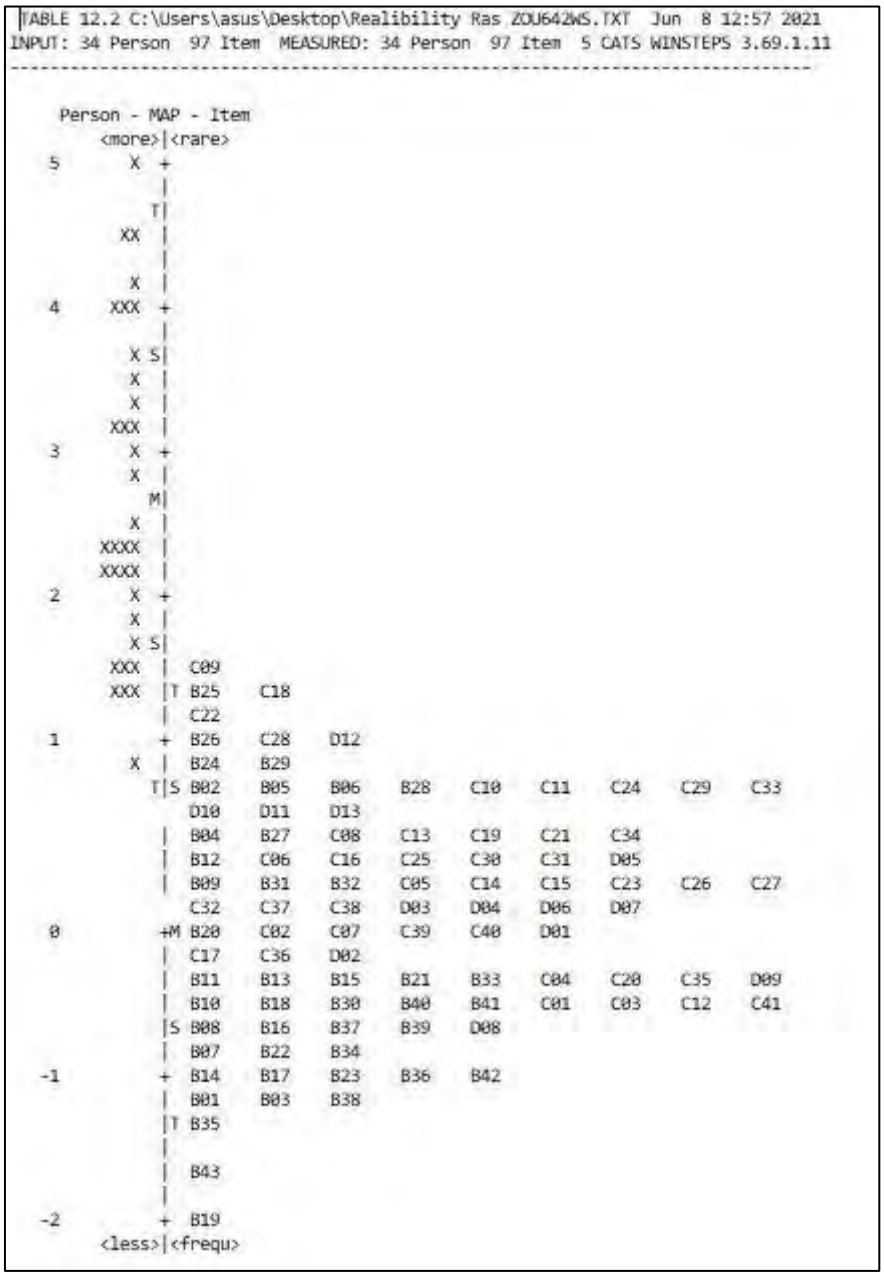

Fig. 1 Wright Map of the study

3.1.2 Statistical fit

To measure the statistical fit of the item, three parameters were referred to. The first parameter, the point measure correlation (PTMEA CORR) for this questionnaire, indicates positive value for all items indicating the items are measuring the related domains. Thus, no items need to be revised based on this output. The next parameters are outfit MNSQ, whereby it indicates 30 items showing a value of MNSQ larger than 1.4 and 30 items with a smaller value than 0.6. Table 4 shows the statistical fit value for the instrument.

Table 4. Statistical fit value for the instrument

Entry Number	Infit		Outfit		Item
	MNSQ	ZSTD	MNSQ	ZSTD	
Item Larger than 1.4					
57	3.48	5.0	4.65	6.3	C14
61	2.70	3.6	4.42	6.5	C18
51	1.71	1.8	2.71	3.9	C08
59	2.60	3.5	2.25	3.1	C16
66	2.21	3.0	2.53	3.5	C23
29	2.02	2.3	2.43	3.5	B29
58	1.90	2.3	2.25	3.0	C15
6	1.19	0.6	2.23	3.1	B06
25	1.70	1.8	2.11	2.9	B25
1	0.94	-0.1	1.79	1.4	B01
8	0.99	0.1	1.76	1.7	B08
65	1.38	1.1	1.66	1.9	C22
9	1.05	0.3	1.55	1.6	B09
94	1.23	0.7	1.46	1.4	D10
67	1.11	0.45	1.45	1.4	C24
Item Smaller than 0.6					
43	0.83	-0.3	.52	-0.6	B43
19	0.81	-0.2	.41	-0.6	B19
35	0.79	-0.5	.51	-0.8	B35
36	0.78	-0.6	.59	-0.8	B36
38	0.75	-0.7	.53	-0.9	B38
44	0.66	-1.2	.53	-1.4	C01
45	0.65	-1.2	.58	-1.4	C02
78	0.64	-1.3	.53	-1.5	C35
11	0.62	-1.4	.51	-1.6	B11
20	0.59	-1.5	.53	-1.6	B20
93	0.58	-1.6	.48	-1.7	D09
53	0.50	-1.6	.57	-1.6	C10
24	0.50	-1.6	.56	-1.6	B24
79	0.51	-1.9	.44	-2.0	C36
80	0.40	-2.3	.38	-2.4	C37

Based on Table 4, items that exceed the value of 1.40 in the MNSQ outfit column are C14 (4.65), C18 (4.42), C08 (2.71), C16 (2.25), C23 (2.53), B29 (2.43), C15 (2.25), B06 (2.23)), B25 (2.11), B01 (1.79), B08 (1.76), C22 (1.66), B09 (1.55), D10 (1.46) and C24 (1.45). While values less than 0.6 are items B43 (0.52), B19 (0.41), B35 (0.59), B36 (0.59), B38 (0.53), C01 (0.53), C02 (0.58), C35 (0.53), B11 (0.51), B20 (0.53), D09 (0.48), C10 (0.57), B24 (0.56), C36 (0.44) and C37 (0.38). Thus from this diagnosis, there were five items dropped while 25 items were revised by looking at the needs of the study and the views of experts.

3.1.3 Standardised Residual Correlation for item dependent

Based on the analysis, there are 10 pairs of items that have a high correlation value that is at a correlation value of 0.89 between items B16 with B17 and items B32 with B33, at a correlation value of 0.83 between B25 and B29, at a correlation value of 0.78 between B27 and B28, at a correlation value 0.74 between PK57 with PK58, and RP75 with RP76, at a correlation value of 0.76 between D01 with D02 and D12 with D13, at a correlation value of 0.75 between C25 with C26, at a correlation value of 0.73 between C31 with C32 and B19 with B43 and at a correlation value of 0.73 between B04 and B05. This means that these items have the same measurement meaning or combine several other dimensions that are shared. Therefore, this item needs to be noted, and one item should be dropped for each pair of items involved. If reference is made to the MNSQ values as per the diagram of the items

involved, then the items that need to be removed are only B25, B29, D01, D13, C25, C31, C32, B19, B43 and B05. The selection of items that need to be removed also needs to be aligned with the removed items based on the negative item value of PT MEASURE CORR., as discussed in the previous analysis. However, the MNSQ value closest to 1.00 was retained, namely items B16, B17, B32, B33, B27, B28, D02, D12, C26, and B04. Table 5 shows the item standardized residual value.

Table 5. Item standardized residual value

Correlation	Entry Number	MNSQ Outfit	Result	Entry Number	MNSQ Outfit	Result
.89	B16	1.13	Keep	B17	0.97	Keep
.89	B32	1.04	Keep	B33	1.11	Keep
.83	B25	2.11	Drop	B29	2.43	Drop
.78	B27	0.98	Keep	B28	0.94	Keep
.76	D01	0.87	Drop	D02	0.92	Keep
.76	D12	0.93	Keep	D13	1.28	Drop
.75	C25	1.27	Drop	C26	1.10	Keep
.74	C31	0.64	Drop	C32	0.74	Drop
.74	B19	0.41	Drop	B43	0.52	Drop
.73	B04	0.96	Keep	B05	0.78	Drop

Once the data were analysed, a review of each item was performed based on the standard index and the conditions that need to be followed to achieve the standard of validity and reliability of the instrument based on the Rasch measurement model. Removal and revised of items are done concerning and taking into account the views and evaluations of experts. After the analysis, several items were dropped from the instrument. Table 6 shows the summary of item status.

Table 6 Summary of item status

Domain	Item Kept	Item Drop	Entry Number
B. Environment	37	6	B5,B25, B19,B29, B38, B43
C. Academic	35	6	C53, C59, C66,C68, C74, C75
D. Psychological-Social	10	3	D85, D94, D97
Total	82	15	

Based on the analysis, 15 items do not meet the analysis requirements that have been set and should be removed. In contrast, 25 items were revised in accordance to the importance of the study context. In total, 15 items were eliminated, bringing the total number of items for this instrument to 82 items, excluding demographics. An overall summary of the relevant question items is as follows.

3.2 Discussion

The multiple roles of student-athletes in the public universities has become a challenge for them to succeed. Student-athletes must be able to differentiate their role as student and athlete and put priority at its place. It was reported that there was a low degree of role separation between student and athlete, whereby those with a high degree were reported to flourish more (Watson et al., 2021). Undeniable, to separate the two roles and excel in both is difficult task for the student-athletes without any supports from the surrounding. Considering their contribution as an athlete to the university and country, they deserve the best possible support that can motivate them to excel in both academic and sport life. Since motivation is not static but dynamic attribute (Kaur et al., 2021), it is crucial to have better understanding on the support that can enhance this motivation.

Furthermore, studies from all around the world had provided evidence on the factors that affect the success of student-athletes, including the burnt-out factor (Into et al., 2020), payment to the student-athletes other than the privilege provided by universities, including fee wave and hostels (Zema, 2018) and the influence factors on the identity and motivation of the student-athletes (Quinaud et al., 2019). All these factors are among the vast secondary data found from online journals and books. However, from the Malaysian context, these factors might provide different effect to student-athletes. Thus, a tailored measurement tool was developed to identify local student-athletes need for their success in academic life.

Based on the findings, three domain of support has been validated to be included in the instrument, which is Environment, Academic and Psychological-Social. Several items from these domains were dropped based on the analysis. The most item drop was from the domain on Environment and Academic and the least item dropped from domain of Psychological-Social. The final instrument consist highest number of item from the domain of Environment, followed by Academic and the least is Psychological-Social. This can be concluded that the Environment support for the student-athletes could be the support that requires more inquires for the stakeholders. However, it does not indicates the level of the importance for the student-athletes as that requires different study.

This study has managed to develop a validated instrument for Academic Enhancement Support for student-athletes in Malaysia with Cronbach's alpha 0.96, which indicate excellent internal consistency. The need for this instrument has been discussed above, based on the local need of the student-athletes and readiness of the stakeholders to contribute. Without a doubt, an academic enhancement support instrument will assist student-athletes in identifying their lack aspect in support that is needed for their academic enhancement. It also helps the stakeholder in Malaysia Public Universities to design the support system for student-athletes accordingly by focusing more on the least support. Therefore, this instrument can be used as monitoring tools for the management system to ensure the support given are optimum and fully utilised by the student-athletes.

This study focus on the student-athletes from Malaysia Public Universities that compete in university and state level. Referring to the study's main objectives, which is to identify the validity and reliability of the instrument, the sample was chosen with the same attribute as the actual sample. Thus, this validated and reliable instrument cannot measure the same domain for a different group of students. This calls for future research on the academic enhancement support instrument for other Malaysian education system.

4. Conclusion

This study aims to find the reliability and validity of the academic enhancement support instrument. The result shows that the instrument is reliable with Cronbach's alpha at 0.96, which indicate the instrument is excellent with high reliability and can be used for the actual study. Overall, 15 items were dropped from this instrument for the misfit, making the validated instrument have 82 items. Thus, Academic Enhancement Support is an instrument with strong validity indicators that can verify the student-athlete's perception of the support required for their academic enhancement.

5. Co-Author Contribution

MZR contributed significantly to the study's concept and design by collecting data and writing the first draught. SP and FANY contributed to the study's design and development phases and approved the final manuscript version. NHH analysed and interpreted the data and assisted in the writing of the manuscript. HFML contributed to the overall structure of the manuscript, including proofreading and revising it.

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