Development and validation of an instrument assessing attitude towards research (ATR)

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Abstract

The primary purpose of this study was to develop and establish the validity and reliability of an instrument assessing Attitude towards Research (ATR) in the context of Filipino senior high school students. Data were gathered from 310 senior high school students from secondary schools of Region 8, Philippines. An exploratory factor analysis with the Principle Component Analysis using parallel analysis factor extraction and varimax rotation method was conducted. The factor analysis produced a meaningful seven factor dimension with a total of 26 items. Reliability was supported by internal consistency values as reflected in acceptable Cronbach's coefficient alpha for the seven factor dimensions. Hence, this instrument may be used to measure attitude towards research of the senior high school students. Thus, the researcher proposed that this adapted and validated instrument be named as Attitude towards Research Scale for Filipino Senior High School Learners.

1. Introduction

The need to develop students' scientific research skills during their undergraduate studies is an answer to the challenges faced in the higher education level [1]. The goal is to have competitive students with strong thinking skills, intellectual analysis, creativity and flexibility, and the capability to create and replicate knowledge. As a learning process, research resulted from conception during the freshmen year of students and not as culmination of their academic journey. The reality is, most of the students start their training in research during their postgraduate studies and not from the undergraduate level that makes the students think that research is more like a requirement to pass and eventually complete their studies that a foundation of their undergraduate studies.

Research is a fundamental function of every university and is not only linked to teachers but also to the learning of the students [2]. The research-based learning is one of the strategies best suited to develop research skills, and learning is built on real scenarios that link teachers and students in a knowledge-building process inspired by the process of scientific research. Benefits from participation in undergraduate research projects involve the nurturing of a scientific mentality and the need to become scientist in the future [3]. Moreover, students indicated that getting immersed in research projects facilitated their learning [4].

The aim of this study is to develop an instrument that measures the research skills of the students and serve as reference to include fundamental scientific research skills on the learning process of students. Furthermore, this study aims to establish the validity and reliability of the instrument.

2. Materials and Methods

2.1 Population and Sample

The population of this study were senior high school students from Samar, Region 8, Philippines aged 17 to 24 and were enrolled for the School Year 2018-2019. Meanwhile the sample of this study consisted of three hundred ten (310) students from former school and one hundred twenty (120) from the latter school selected through stratified random sampling. The inclusion criteria were as follows:

1. Full-time senior high school students
2. Ability to read and write
3. Able to comprehend and follow verbal instructions
4. Willing to be included in the study

2.2. Instrument

The researcher developed an Attitude towards Research Scale (ATRS) for high school learners of aged 16 to 25 and aims to establish its validity and reliability. Attitude towards Research Scale (ATRS) is an instrument to measure the attitude towards research of high school learners in a rating scale with an initial design of thirty (30) statements. Statements were created from review of literate and significant studies and focused-group discussion with selected senior high school students. During the interview, students were asked to describe how they feel about research, and their perception towards the subject. Accordingly, responses were recorded and transformed into statements that constituted the items in the scale. The response format used in the scale are as follows: 1 for Strongly Disagree, 2 for Disagree, 3 for Neutral, 4 for Agree, and 5 for Strongly Agree.

2.3. Design and Procedure

This study employed an exploratory sequential mixed method design, primarily focusing on instrument-development because its objectives is to develop a scale measuring the senior high school students' attitude towards research. The researcher was interested in following up qualitative findings with quantitative analysis. This two-phase approach is particularly useful for developing a new instrument [5].

The researcher used the qualitative (exploratory) findings from the first phase to help develop the instrument or treatment and then tests this product during the second phase (quantitative). In general, when variables are unknown, this approach is useful to identify important variables from (Phase 1) for subsequent quantitative analysis (Phase 2) [6].

The development of the scale started from crafting statements based on literature review on the concept of "attitude towards research," focus group discussion, semi-structured interviews, and field observation with selected senior high school students. Next, the statements were subjected to separate and individual evaluation as well as group evaluation from three (3) experts in the field of Research, Education and Psychology. A 100% agreement standard among the experts in judging each item of the scale was used for an item to be retained, deleted or otherwise, revised.

Then a pilot testing of the instrument was implemented to one hundred twenty (120) senior high school. Data from the pilot test was used to analyze the item in the scale. Independent samples t-test was conducted per item, and items which were not significantly different from the upper and lower groups were rejected.

After changes were implemented to the instrument from the result of the pilot test, it was given back to the panel of experts for a second phase evaluation before coming up with an instrument that is revised based on their suggestions. Final administration of the instrument was conducted to three hundred ten (310) students for psychometric properties and factorial components analysis.

2.4. Data Analysis

For Phase 1, coding and thematic analysis of qualitative data were used. The following steps represent Colaizzi process for phenomenological data analysis [7]. (1) Each transcript should be read and re-read in order to obtain a general sense about the whole content. (2) For each transcript, significant statements that pertain to the phenomenon under study should be extracted. These statements must be recorded on a separate sheet noting their pages and line numbers. (3) Meaning should be formulated from these significant statements. (4) The formulated meanings should be sorted in categories, cluster of themes, and subthemes. (5) The findings of the study should be integrated into an exhaustive description of the phenomenon under study. (6) The fundamental structure of the phenomenon should be described. (7) Finally, validation of the findings should be sought from the research participants to compare the researcher's descriptive results with their experiences.

For Phase 2, to identify the psychometric properties of the scale (validity and reliability), experts in the field of Research, Education and Psychology were asked to check the content validity of the instrument. Meanwhile, to check the reliability of the instrument, Cronbach's Alpha was used. Finally, to establish the factorial component of the instrument, Principal Component Analysis was implemented.

In order to produce the scale's dimensionality, and the simplification of the factors, several criteria in determining factor extraction were considered.

1. The scree plot displayed the point of inflection.
2. Eigenvalues of more than 1 leads to an overestimation of the number of factors to retain [8].
3. Proportion variance accounted for criterion.
4. A loading of 0.35 served as the cut-off point [9].
5. Parallel analysis will be implemented [10].
6. Cronbach's Alpha of at least 0.70 is the acceptance level of internal consistency [11].

3. Results and Discussion
3.1. Psychometric Properties of Attitude towards Research Scale
To identify the psychometric properties of the scale, its content validity and reliability using Cronbach's alpha were established.

3.1.1. Content Validity of the Scale
After the creation of the items for the scale started from crafting statements based on literature review on the concept of "attitude towards research," focus group discussion, semi-structured interviews, and field observation with selected senior high school students. Next, the statements were subjected to separate and individual evaluation as well as group evaluation from three (3) experts in the field of Research, Education and Psychology to ensure that these items were measuring attitude towards research. A 100% agreement standard among experts in judging each item of the scale was used for items to be retained, deleted or otherwise, revised. As a result, none of the items were deleted after the individual and group evaluation of the experts. Likewise, suggestions given by the experts to revise some sentences, rephrasing, paraphrasing and changing of selected words were considered and implemented.

3.1.2. Reliability of the Scale
To examine the reliability of the scale or its internal consistency, the Cronbach's Alpha was calculated. Since the scale is multidimensional, thus the Cronbach Alpha for every subscale was computed. For *Research Outlook Subscale*, it has a Cronbach's Alpha coefficient of 0.0815; *Research Apprehension Subscale* got a Cronbach's Alpha coefficient of 0.815, and *Research Utilization Subscale* got a Cronbach's Alpha coefficient of 0.769. Generally, in all dimensions, the instrument got a Cronbach's Alpha coefficient greater than 0.700 thus establishing reliability.

The Cronbach's Alpha coefficient of the entire scale is 0.743 and is considered a high level of internal consistency, interpreted as acceptable [12].

3.2. Factorial Components of Attitude towards Research Scale
The KMO index was found to be 0.646 which was considered adequate and above the recommended minimum of 0.6 (Chan & Idris, 2017). The result of Bartlett's Test of Sphericity was significant ($p \leq .001$) indicating that it was appropriate to conduct principal component analysis.

Results of the principal component analysis revealed the presence of ten (10) components with eigenvalues exceeding 1. This explains a total of 61.64 percent of the variance with each dimensions contributing 11.34 percent, 9.69 percent, 7.88 percent, 6.65 percent, 5.73 percent, 4.66 percent, 4.397 percent, 4.14 percent, 3.609 percent, 3.538 percent.

The scree plot showed point of inflection the first factor (figure 1) and started to level off after ten factor. The factors that lie before the point at which eigenvalues begin to drop off can be

retained. There were ten factors which had initial eigenvalues greater than 1, the scree plot also suggests a different number of factors to be considered, against the original three factors.
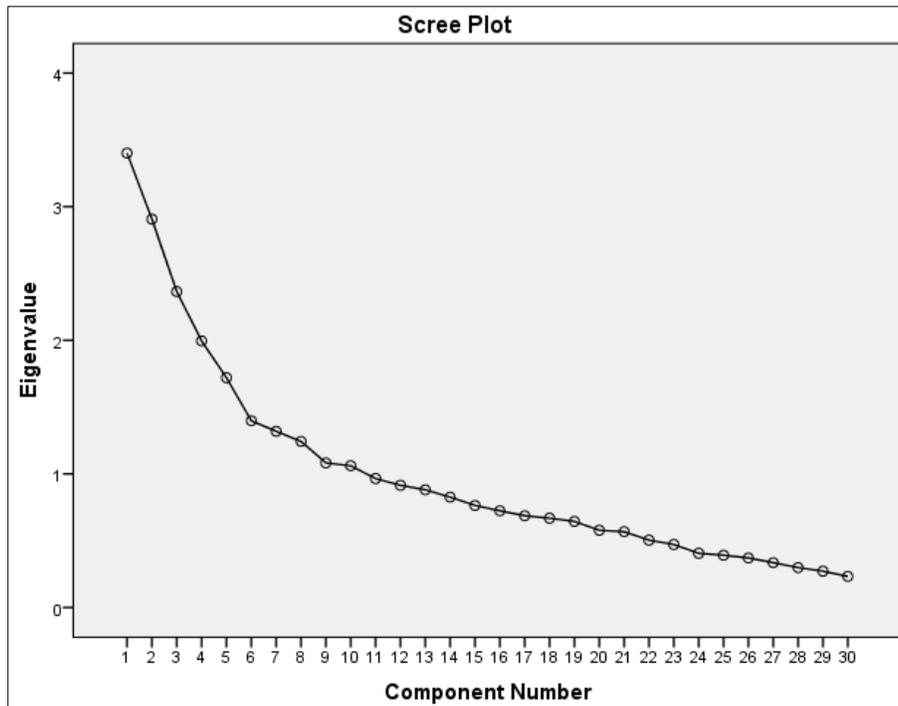
Fig 1: Scree Plot of the Items and their Corresponding Eigenvalues

Moreover, another factor extraction technique used in this study is the Parallel Analysis (Monte Carlo Parallel Analysis), in which actual eigenvalues are compared with other random order eigenvalues. Factors are retained when actual eigenvalues surpass random ordered eigenvalues. In this study, parallel analysis revealed seven factor model as shown on Table 1. Since parallel analysis is more accurate and a conservative approach that takes into account the sampling error biasing influence, the researcher considers this extraction technique to make the most conceptual sense [13].

Table 1: Parallel Analysis

Component	Actual Eigenvalue	Random Order Eigenvalues	Decision
1	3.401092	1.706370	Accept
2	2.907084	1.592495	Accept
3	2.364582	1.525203	Accept
4	1.995229	1.466990	Accept
5	1.720212	1.407824	Accept
6	1.397869	1.357265	Accept
7	1.319098	1.309650	Accept

Since the criterion for retaining an item was a factor loading of $\geq$ 0.35 [9], the researcher considered twenty-six (26) items in the factor where loaded higher. Twenty-six items were retained and re-categorized into seven dimensions instead of the original three dimensions.

Table 2: Sorted Rotated Factor Loadings and Communalities

Variable	Factor						
	1	2	3	4	5	6	7
Q01	0.651						
Q02					0.589		
Q03	0.437						
Q04						0.707	
Q05	0.646						
Q06						0.717	
Q07	0.733						
Q08	0.73						

Q09	0.499					
Q10						0.497	
Q11		0.274				
Q12		0.635				
Q13		0.752				
Q14		0.728				
Q15		0.522				
Q16					0.604	
Q17					0.591	
Q18					0.584	
Q19				0.399		
Q20			0.546			
Q21				0.507		
Q22			0.62			
Q23			0.357			
Q24						0.448	
Q25				0.604		
Q26						0.697

4. Conclusions

In summary, the study proved that the Attitude towards Research Scale (ATRS) developed by the researcher were composed of seven dimensions. The scale is reliable and valid thus this instrument may be used to measure attitude towards research in school for senior high school learners of age 17 to 24 years old. In this regard, the researcher proposed that this developed and validated instrument be named as Attitude towards Research Scale for Filipino Senior High School Learners

5. References

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