Development And Validation Of Questionnaire For Measuring Senior High School Fundamental Scientific Research Skills

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Abstract: With the advent of the introduction of research courses in the basic education program in the Philippines, varied measures on the attainment of learning outcomes have been in debate, one issue is the sizing of student scientific research skills after completion of research subjects. However, there has been no notable instrument developed and validated that measures fundamental research skills in basic education, especially in senior high school. Thus, this study aimed to develop and validate such an instrument. The process includes literature and resources review, formulation of new items, language and content validation, factor analysis, reliability, and concurrent validity testing. The instrument was implemented for 229 Grade 11 and 12 students for the exploratory factor analysis and additional 95 students for the reliability and concurrent validity testing. Statistical results revealed significant and adequate value measurement of factor analysis, reliability, and validity testing. Suggesting that the developed instrument can be used for measuring student fundamental scientific research skills and as a basis for further studies of research skills in basic education.

Keywords: Fundamental Research Skills, STEM Education, Science Education, Senior High School, Research Policy

1. Introduction & Background

Basic education institutions in the Philippines are just starting to embrace the culture of research. Commonly students upon completion of basic education proceed with higher education level and are expected to possess functional knowledge in scientific, critical, and creative thinking and use of technologies and able to apply sound reasoning, informed decision-making, and the judicious use of resources, all are reflected with their research output. Moreover, a baccalaureate degree qualification demands students to apply and create research in a specialized field of discipline and/or further study [20], which requires mastery of the basic education qualifications. For a STEM student to be able to produce quality scientific research follows a framework, commonly using the scientific method [10], [14]. In this framework, the student must be able to (1) critically observe, (2) ask questions and one can only critically observe and ask a question if they have become knowledgeable of various concepts and principles in science, (3) students then construct hypothesis in which they can only achieve with at least a basic skills in reasoning, assessing and evaluating information and data at hand, (4) Test hypothesis, that requires the ability to design experiment, solve complex problems that involve multiple steps, and navigate through unfamiliar situations and information, (5) after this students must analyze the data and draw a conclusion which also in need of the higher order thinking skills that international assessment measures and lastly (6) share results, in this case, students ability to craft and create a cohesive paper presenting the process of hypothesizing, to designing the experiment to result from collection, analysis, and conclusion.

Scientific Research Skills (SRS) is a relatable concept to a more known Science Process Skills (SPS) which is defined as a set of thinking skills that scientists use to develop knowledge to solve problems and construct results. SRS is a more advanced knowledge and skills, it includes the ability of the student to identify and control variables, the ability to organize and analyze information both primary and secondary resources as well as defining operationally, formulating hypotheses, interpreting data, experimenting, formulating models, and presenting information demands usage [19], all which falls under the cognitive thinking domain.

The research was a learning process was investigated as a product of various processes and strategies that were hypothesized to have started from the years of first formal academic exposure [6], thus it is imperative that research training and skills required for it are honed at the very basic level where formative learning is being developed among the students, which translate to their secondary educational level including senior high school. Therefore, the principle in which students start rigorous research training can be dated and measured entirely in the postgraduate research and not from the undergraduate, much less basic education years, makes students view research and its process as a requirement for a degree rather than the foundation of their education [6]. In this regard, it is necessary to build research skills in earlier years and in this regard, an appropriate research skill measuring instrument is needed.

The theoretical basis of cognitive skills and SPS and SRS can be dated with the intellectual development theory of Piaget (1996) as discussed by Flavell [9] in which students' ability to assimilate and accommodate learning from their environment is defined as cognitive domain skills, the last stage of Piaget's cognitive learning theory, the formal operational stage provided information on the relationship between students ability to learn abstract science in which they can reason, theorize, propositional, hypothesis and combinatorically reason out concepts and information [9], [18] a clear manifestation of cognitive thinking domain that is also a vivid representation of needed skills in doing scientific method and research [14].

Several studies have already established the importance of training students in research and its subsequent skills [12], [28], ranging from its impact on students' overall output to their scientific skills to self-efficacy and lifelong learning development up to studies that provided educational effectiveness of research experience of undergraduates to advantages of research-based learning [23]. Thus, institutions must have tools in measuring fundamental scientific research skills among SHS students. With the varied claims and suggestions of researchers in increasing student research skills [4], [21]. There is still a gap in a created instrument that can directly measure student research skills much less with a validated and aimed for standardizing psychometric test for these lifelong skills, much less, thus, this instrument development proceeded with creating an instrument that can help in filling out this gap, especially in basic education. Research in basic education was only introduced during the approval of the legal basis for the addition of two more years to expand high school education in preparation for the tertiary level. The Republic Act No. 10533 known as the Enhanced Basic Education Act of 2013, broadens the goals for college, vocational, and technical career opportunities. Under this law, the Department of Education (DepEd) released its department order (DO) no. 21 s. 2019, Policy Guidelines on K to 12 Basic Education Program, that support standardization of the K to 12 implementations [7].

Annexes of the policy guidelines inherently provides the curricular courses included in the two major division of basic education namely: Elementary and Secondary Education. Secondary education is divided into two phases the junior high school (JHS) phase which includes Grade 7 to 10 and Senior High School (SHS) Grade 11 to 12. In the JHS no particular learning area is specifically dedicated to research, particularly true across the four grade levels (DO 8, s. 2015; DO 36, s. 2016). It is in SHS that research courses are explicitly introduced to students. In the SHS core curriculum courses, two courses' outcomes provide skills that lead to systematic, in the applied course of the SHS tracks, three courses are dedicated to research this is Practical Research 1, dealing with qualitative research, and Practical Research 2 which trains the student for quantitative research and Inquires, Investigations and Immersion, on the practical application of research and integrative, scientific, and creative academic manner. In the Science Technology, Engineering, and Mathematics (STEM) Strand, the students will also have their final research commonly termed as Research capstone [7] requiring students as their outcome a well-written research report [1], [16], [17].

Premise claims consensual agreement that students need scientific thinking skills to understand science concepts, and their application every day (National Research Council, 2012). Skills needed in the scientific method can collectively be termed as Science Process Skills equated with Science Research Skills [19]. Literature showed that researchers' qualification such as skills and academic characteristics is a predictive factors for research productivity, as an individual increase qualification research productivity elevates [1], [26]. Regardless, little to no investigation has focused on students' scientific research skills and how it affects student research productivity, much more in the context of basic education.

Cobos-Alvarado et al. [6] developed a 20-item instrument that claimed to measure research skills among engineering students, although the instrument was created using the textbook procedure in test and scale construction [29] using its three staged development, including factorial validity testing, however, the instrument was intended for higher education students. The measured student scientific research skills and use the corresponding data to be gathered as diagnostic and learning gain assessment of students, especially for courses that are particular with honing student skills in research conduct and writing such as practical research courses in the senior high school. In detail, the test being assessed with high internal consistency provides good evidence of its adaptability and can be used across differential groups of students applying for individual assessment based on its value of .91 [11], however, the internal consistency test could not mean that the test can be used over time if the research would like to assess this test-re-test method should have been used to measure the test stability over time and testing the instrument for error in test takers and administration [5]. Lastly, the test was intended for engineering students of higher education, thus a need for an appropriate measuring tool for senior high school (SHS) specifically for Science, Technology, Engineering, and Mathematics (STEM) students.

Thus, this study tried to develop and validate an instrument intended for this research instrumentation gap.

2.0 Methodology

2.1 Participants and sampling procedure

Participants include Grades 11 & 12 STEM SHS students for the academic year 2020-2021 (n=229) for the Exploratory Factor Analysis (EFA) and 95 other students for the reliability testing and correlation analysis, sampled using stratified random sampling. Ten (10) teachers were selected using purposive sampling with the primary criteria of being at least able to teach or have taught research courses in SHS for an entire academic year, they were asked to evaluate the quality of completed papers by a student who participated in the study, data on quality of research will be used for criterion-related validity of the study.

Two (2) experts with doctoral degrees evaluated and provided comments and suggestions regarding the content validity and language validity of the original instrument called the fundamental scientific research skills instrument (FunSRS) and provided subsequent comments and suggestions using the research-made matrix. All participants were from a private school in Cabanatuan City, Nueva Ecija, a CHEd and ISO-accredited higher education institution that offered STEM from 2017 up to the present. All research output of the institution was retrieved from the senior high school library. Ethical procedures and legal approvals were secured before the gathering of data and implementation of the study.

2.2 Original Item Development and Scale Construction

The first stage of the item development was the review of literature that has tried to create a research skill measuring instrument: First, the main literature used by the study of Cobos-alvarado et al. [6], a 20-itemed self-report instrument called AHABI categorizing student research skills into three main divisions: Process scientific information (Questions 7, 8, 9, 10, 11, 12, 13 and 17); Managing scientific information (Questions 1, 2, 3, 4, 5, 6 and 18); and Develop scientific information (Questions 14, 15, 16, 19 and 20), these three categories were adapted and modified together with the definition into the following: (A) Scientific Research Processing Skills (SRPS), category that measures the ability of students to understand, process, analyze varied aspect of research, its planning, implementation, and writing, 19 items were placed under this category in the original instrument; (B) Scientific Research Managing Skills (SRMS), category that measures the ability of the student to search, manage, organize and systematically structure various aspect of research and scientific information, 15 items were placed in this category; and (C) Scientific Information Development Skills (SIDS), category that measures the of the student to formulate scientific information for the various aspect of research and its implementation, 14 items were included in this category.

Twelve items were drawn and improved from this instrument, including item placements to the more appropriate category, to improve item validity. The inclusion of modal auxiliary verbs at the beginning of the sentences such as “can” and “able”, improves sentence structure, total reading ease, and language validity.

Second, the instrument referred to in the item development was the questionnaire for identifying general skills and qualities of scientific research of Fernández et al., [8], five (5) items were adapted from this instrument and placed under the SRPS and SRMS. The third, literature referred to be the self-assessment instrument research skills of Rivera and Torres [22] in which seven (7) items were drawn that were placed under the SRPS and SIDS category. Lastly, the inventory of skills for university research (ICUNI) Sierra, Alejo, and Silva [25] by which three (3) additional items were drawn.

This stage completes the standard approach that is widely used when creating scale instruments, reviewing literature that can provide information, context, and at some point, the relevant structure of the scale to be produced based on the theory and conceptual basis of the proposed instrument [29]. But to further the item development ensuring that the instrument will encompass a wider selection of research skills. The development process added ten additional items created based on the context aimed by the most essential learning competencies of the Department of Education Curriculum under the DepEd Order 21 series of 2019 [7], and seven additional new items based on the context and principles discussed by the following books: One, tips and techniques in writing research by Magsajo-Sarno [18]; Two, Practical Research 1 by Baceros [2]. And Practical Research 2 by Baraceros [2]. Creating a total of 48 items for the entire original instrument which will be called the Fundamental Scientific Research Skills (FunSRS) Questionnaire.

2.3 Three-staged Content Validity

In the content validation cycle one, one of the major comments of both the experts were to transfer question 1, 10, 11, and 14 to scientific information development skills from the original placement in the scientific research processing skills, both agreed that these items are more valid to measure student capacity to formulate scientific information rather than processing information. The second revision includes the merging of questions such as questions 2 and 3, questions 4 and 5, merging into one of questions 16 and 17, as well as the unison of questions 23 and 25, in which the experts deliberately suggested the sameness of principles being measured by these items, thus, imperative for merging to avoid redundancy which can be detected when the instrument will be measured with internal consistency as well as reduce the number of items to ensure the conciseness and amount of time needed for the instrument to be accomplished. Third, the critique suggested the addition of items for the scientific research managing skills on managing research writing and managing the actual research implementation and experimentation and for the Scientific Information Development Skills on adding an itemset for the formulation of interpretation. The fourth revision was a deletion of item number 26. Lastly, several items were asked to be rephrased for grammatical concerns, the addition of words for better sentence structure, and the deletion of words based on the principle that the scale will be a progression of skills evaluation rather than agreement. All of these are accomplished, in this stage, the 48 original items were reduced to 45 with the inclusion of new items as suggested by the experts. This was again plotted in another excel sheet for the second cycle of content validation.

In the second cycle the experts had additional comments and suggestion such as merging of questions 3 and 4 which are about interpretation and summary of data into question 1, which were agreeable, question 5 and 6 where also suggested to be unified into one which is about discussion of data interpretation, question 7, 8 and 9 were also merged into one since all questions were about data analysis, question 14 and 23 was also merged since both questions were perceived the same in underlying principle about organization of literature, question 22 and 24 were also unified since both questions talks about managing the implementation of the study, question 37, 41 were subsumed with question 31 which measured student skills in developing a research topic, the deletion of question 21 due to the reason of it being the actual category being measured 42, 43 and 44 were unified into one question regarding student skills in formulating conclusion while most of the revisions surrounds in improving the sentence by the removal of certain verbs in the sentence for a more concise items. After which, all comments and suggestions were incorporated into the instrument producing the third form of the instrument was reverted again to the expert for final checking and was approved accordingly, producing the final 26-item FunSRS divided into the following, seven (7) items for the SRPS, nine (9) items for SRMS and ten (10) for SIDS.

For the scale the developer adopted the DepEd Mastery Classification Bracket which corresponds to absolutely no mastery (1), very low (2), low (3), average (4), moving towards mastery (5), closely approximating mastery (6), mastered (7). The scale was agreed upon by the experts as it was found to be more appropriate in accurately evaluating oneself on the varied skills being measured in the instrument.

3.0 Results and Discussion

3.1 Exploratory Factor Analysis

Using principal component analysis and varimax rotation, with minimum factor loading criteria of 0.50, the commonality of the scale which indicates the amount of variance in each dimension was also assessed to ensure acceptable levels of explanation. The results show that all commonalities were over 0.50 except for questions 11, 13, 16, and 23 had slightly lower communality values at .492, .483, .418, and .465, respectively. Bartlett's test of sphericity, which provides a measure of probability on correlation matrix was significant, X2 (n=229) = 3782.520 ($p < 0.001$), which indicated suitability.

Kaiser-Meyer-olkin MSA sampling adequacy shows adequate sampling for the factor analysis to proceed, indicating the appropriateness of data at 0.797. Initially, the factor solution derived from the analysis produced six factors for the scale which accounted for 68.75% of the variation in data. The eigenvalue of all the six-factor loadings was above the standard value of 1 based on the criterion set by [13] (Table 1). However, it is notable that the eigenvalue is more than 2 at the proposed three-factor dimension of the instrument, providing evidence that most of the factors are loaded in three major factor loadings [13].

Table 1. *The eigenvalue of six-factor loadings*

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	6.047	23.256	23.256
2	4.878	18.763	42.019
3	2.989	11.497	53.517
4	1.465	5.635	59.152
5	1.334	5.13	64.283
6	1.163	4.473	68.755

Initial EFA is also revealed using the rotated component matrix that questions 2, 4, 7, 9, 20, 22, and 23, though with over 0.5 communality value is loaded onto a factor other than the respective underlying factors. The principal component analysis and varimax rotation results reveal that these questions do principally not measure the same dimensions as others and with the proposed three dimensions the results suggest many variables into a smaller number of components [27]. Initially, questions 1 and 2 were removed, resulting to question 7 being loaded into its appropriate factor, does it was not removed. Questions 9, 20, 22, and 23, were removed as well since stepwise deletion of factors did not change their factor loading into the appropriate underlying constructs (Table 2).

Table 2. *Initial Exploratory Factor Analysis*

Statements	1	2	3	4	5	6
I can appropriately analyze main ideas of a varied data source such as literature and my own experiment.			0.875			
I can interpret information from different data source such as literature and my own experiment.				0.861		
I can discuss data interpretation from different data sources such as literature and my own experiment.			0.868			
I can analyze available data and information.				0.87		
I can appropriately use statistical procedures in my analysis.			0.845			
I can choose reliable information from varied data sources.			0.82			
I can appropriately use scientific procedures in implementing experiments.				0.803		
I can manage research articles of a theme drawn from scientific journals, databases, etc.		0.652				
I can organize scientific data different varied information sources such as literature and my own experiment.						0.895
I can recognize a scientific paper in reputable resources.		0.75				
I can communicate orally or written the results of a review of scientific literature.		0.65				
I can identify gaps in the articles I read from literatures and related studies.		0.713				
I can systematically plan research and its implementation based on scientific rules.		0.658				
I can appropriately organize the structure of data analysis based on scientific rules.		0.703				
I can systematically manage the actual study or experimentation implementation		0.808				
I can systematically manage the actual research writing.		0.531				
I can develop my own scientific inquiry or question based on data available at hand that are scientifically correct.	0.656					
I can prepare an abstract of a research topic.	0.744					
I create references according to rules of scientific writing.	0.860					

I can bring my ideas in developing a research topic.		0.713
I can create my own hypothesis.	0.834	
I can develop English keywords for a research topic.		0.800
I can appropriately create scientific procedures for a study based on literature.		0.501
I can create correct recommendations based on the result of my own study.	0.821	
I can create appropriate rationale of my study.	0.802	
I can make correctly create my own conclusions.	0.891	

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.

The new EFA analysis confirmed three factor-dimension structure as theoretically defined during the instrument development with Kaiser-Meyer-olkin MSA at .845 higher than the initial value indicating a more appropriate data set than the original factors. Bartletts Test of sphericity was still significant X2 (n=229) = 27006.823 (p <.0001) and all communalities were over and above 0.05 except for questions 7, 8, 11, 13, 16 and 17 which are still acceptable at the values, .489, .488, .442,. 475, .313 and .427. The three-dimension explains a total of 61.90% of the variance among items in the instrument and the eigenvalue for the three-factor loading exceed the standard value of 1 at 2.719 [13] (Table 3).

Table 3. *Eigen value of three factor loadings*

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.056	25.280	25.280
2	4.604	23.021	48.302
3	2.719	13.596	61.898

Factor 1, measures student ability to develop scientific information in this study called Scientific Information Development Skills includes questions 14 to 20, while Factor 2 measures student managing skills including questions 6 to 13, and lastly Factor 3 includes questions 1 to 5 that measure student scientific research processing skills (Table 4). All of which are over and above 0.05 values at 29% non-redundant residuals.

Table 4. *Final Exploratory Factor Analysis.*

Rotation Component Matrix				
		1	2	3
Factor 3 Scientific Research Processing Skills				
1	I can appropriately analyze main ideas of a varied data source such as literature and my own experiment.			0.912
2	I can discuss data interpretation from different data sources such as literature and my own experiment.			0.896
3	I can appropriately use statistical procedures in my analysis.			0.847
4	I can choose reliable information from varied data sources.			0.832
5	I can appropriately use scientific procedures in implementing experiments.			0.674
Factor 2 Scientific Research Managing Skills				
6	I can manage research articles of a theme drawn from scientific journals, databases, etc.		0.663	
7	I can recognize a scientific paper in reputable resources.		0.751	
8	I can communicate orally or written the results of a review of scientific literature.		0.652	
9	I can identify gaps in the articles I read from literatures and related studies.		0.733	
10	I can systematically plan research and its implementation based on scientific rules.		0.663	
11	I can appropriately organize the structure of data analysis based on scientific rules.		0.688	
12	I can systematically manage the actual study or experimentation implementation		0.820	
13	I can systematically manage the actual research writing.		0.536	
Factor 1 Scientific Information Development Skills				
14	I can develop my own scientific inquiry or question based on data available at hand that are scientifically correct.	0.625		
15	I can prepare an abstract of a research topic.	0.759		
16	I can bring my ideas in developing a research topic.	0.857		
17	I can create my own hypothesis.	0.839		
18	I can create correct recommendations based on the result of my own study.	0.846		
19	I can create appropriate rationale of my study.	0.822		
20	I can make correctly create my own conclusions.	0.898		

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

The final instrument is composed of a total of 21 items, as divided into three: Five (5) for the SRPS placed as questions 1 to 5 respectively; Eight (8) items for the SRMS placed as questions 6 to 13; Lastly, seven (7) items for SIDS placed as questions 14 to 20. Using the proposed 7-point Likert scale based on the mastery classification the final instrument has been developed.

3.2 Instrument Reliability

The FunSRS questionnaire was then tested for Internal Consistency, using the Cronbach Alpha test, overall, the final form of the instrument used has good and high internal consistency, Cronbach alpha at .841, indicative of good measure for individual measurement and high satisfactory level for group measurement [11]. To make sure that each of the three categories has consistency among the items, the Cronbach alpha test was also employed. Scientific research processing skills were revealed to have, excellent internal consistency, Cronbach alpha at .874, indicative of an adequate value for individual measurement and diagnosis. Scientific research management skills with Cronbach alpha of .752, a value adequate for group measurement. Lastly, Scientific information development skills with Cronbach alpha of .964, indicative of very high internal consistency of adequate value for individual measurement and diagnosis [11].

These results show that the instrument is at least free of major test administration and intra-test errors. This means factors like varied time of test taking, devices, the physical environment, and other test administration error factors are negligible and do not affect the instrument. Moreover, this adequate internal consistency is indicative that the test itself does not include poorly constructed items, ambiguous items, very easy items, and very high vocabulary reading level levels [5] [15]. After two weeks, the test was re-administered to 95 students, they were re-tested with the same instrument, to determine the stability of the test over time. Pearson r moment correlation was used since the data are interval, randomized, and assumed normal using the central limit theory. Pearson r revealed that through the time interval the instrument has stability, evidenced by the significant positive relationship between each of the three dimensions of the instrument, scientific research processing skills (SRPS) are significantly correlated at a .01 confidence level with the re-tested values ($r = .546$, $p < .0001$), the same goes with scientific research managing skills (SRMS) ($r = .671$, $p < .0001$) and scientific information development skills (SIDS) ($r = .777$, $p < .0001$), as well as the overall values between the two testing times ($r = .827$, $p < .0001$) (Table 6). providing evidence of stability over time, indicative of free from errors due to examinees or test takers include illness, fatigue, hunger, emotional problems, and new learning skills obtained after the first administration of the test, as well as another dimension for evidencing instrument stability over varied test administration factors [5], [15].

Table 5. *Pearson r Moment Correlation between first and second instrument administration.*

First Test Administration	Second test administration			
SRPS Score 1	SRPS Score 2	SRMS Score 2	SIDS Score 2	Overall FunSRS Score 2
Pearson Correlation	.546**	-	-	-
Sig. (2-tailed)	0	-	-	-
SRMS Score 1				
Pearson Correlation	-	.671**	-	-
Sig. (2-tailed)	-	0	-	-
SIDS Score 1				
Pearson Correlation	-	-	.777**	-
Sig. (2-tailed)	-	-	0	-
Overall FunSRS Score 1				
Pearson Correlation	-	-	-	.827**
Sig. (2-tailed)	-	-	-	0

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

3.3 Concurrent Criterion-related Validity

Skills needed in the scientific method can collectively be termed as Science Process Skills equated with Science Research Skills [19]. Literature showed that researchers' qualification such as skills and academic characteristics is a predictive factors for research productivity, as an individual increase qualification research productivity elevates [1], [26]. For a STEM student to be able to produce quality scientific research follows a framework, commonly using scientific methods [10], [14]. The recent unpublished study of Santiago & Soliven [24] revealed that there is a direct positive relationship between student scientific research skills and the quality of research paper student produces, indicating that as student SRS increases such as skills in managing scientific information from own experiment and related studies and literature, and their processing scientific information ability in an organized, appropriate and correct scientific-based guidelines such as skills to analyze data, discuss scientific findings, analyze information from own experiment and/or pieces of literature and various data sources and lastly, student ability to developing their scientific inquiry and hypothesis, to formulate scientific information from literature and own experiment, to devising research plans and its implementation, are vital factors in the quality of research paper is completed the quality of the paper they create increases as well. Thus, one of the most appropriate constructs to prove the validity of the newly created scientific research skill measuring instrument is to determine if it has a positive correlation with the quality score of the research paper the participating students have produced.

Pearson correlation revealed that the overall score of students in the FunSRS instrument is highly positively correlated with the overall quality of the research paper the students completed, ($r = .982$, $p < .0001$) at a 0.01 significance level, indicative of a very good concurrent criterion-related validity of the instrument. Although it can be seen the two of the dimensions SRPS and SRMS were not found to be significantly correlated we can still assume that overall, the instrument is valid in measuring student scientific research skills, especially the SIDS dimension which was found to be significantly correlated, $r = .318$, $p < .05$ (Table 7). All agree with the information on the relationship between student SRS and the quality of research papers [10], [14], [24].

4.0 Conclusion

In conclusion, generally, the FunSRS instrument developed can be used in measuring student scientific research skills. The three-stage content validation process by the two experts, adequate Factorial analysis result using exploratory factor analysis and the reliability testing for both internal consistency and test re-test analysis together with the subsequent concurrent criterion-related validity against the quality of completed research paper by the students, provided adequate information on the validity, reliability, and factor structure of the instrument for use.

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6.0 Declaration of interest statement

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