

## **The component structure of a research skill scale of Omani university students**

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### **Abstract**

Universities and educational institutions are concerned with developing students' research skills and motivating them to do research and hone their creative ability through inviting them to produce good research. The study aimed to identify the component structure of a research skill scale of Omani university students. The study sample consisted of 400 students from A'Sharqiyah university on the academic year 2021 – 2022. A descriptive approach was used in collecting the data through Skewness and Kurtosis values. The suitability of the sample size for the use (EFA) was confirmed as its results showed the saturation of all the scale items with one component only whose Eigen value was 22.478 which represents 74.924% of the overall variance of the items. This is a high value and a good indicator of the reliability of this component. The validity of the internal consistency of the scale items was checked. The correlation coefficients of the items compared to the overall degree of the scale without the items themselves ranged between 0.827 and 0.872 which are high correlation coefficients. The findings also showed that the scale had high reliability indicators as Cronbach Alpha value was 0.988, and when the items were deleted there was no change in the Cronbach Alpha value which indicated that the scale items were connected, consistent and coherent. The reliability coefficient was calculated using the split-half method. The reliability coefficient of Spearman-Brown was 0.962, and the reliability coefficient of Guttman was 0.962 which are both high reliability coefficients. This also confirmed the reliability of the scale items. The study concluded that the research skill scale of the university students had psychometric properties and a good component structure which made it a proper scale capable of testing the degree to which university students possess research skills.

**Key words:** component structure, research skills psychometric properties, Sultanate of Oman

### **Introduction**

Faculty are considered the pillar of academic work as they guide students in their research and instigate their motivation to explore and suggest solutions to research problems. Bu Jalal (2018) referred to the importance of faculty as they are responsible for teaching, researching and community service. They are also responsible for providing students with an appropriate approach while teaching them the research skills which are necessary to help them prepare research.

Universities urge students to do research that benefits both society and their institutions through developing their skills and motivation to carry out research. Al-Najjar (2018) thinks that research is one of the most important functions of universities as it is the center of creativity and knowledge growth and can be utilized to solve social problems. Students cannot do full research unless they have basic skills which they must acquire to do research, and here lies the role of universities and academic institutions in developing and honing these skills through holding training workshops or adding courses concerned with doing research.

Students might have the motivation to do research, but their inadequate research skills will impede their progress and intention to do research. Sahan and Tarhan (2015) think it is necessary to develop students' research skills the way they should develop, and there must be a positive attitude to research which can be realized through including research courses in colleges to teach students these skills. In the light of the importance of research and the interest of institutions in research, the present study sought to identify the degree to which the students at A'Sharqiyah University possessed research skills from their perspective.

## **Research problem**

Although educational institutions are interested in, and aware of, the importance of research, plenty of studies have showed that higher education students are weak in research. Afanah (2011) showed that postgraduate students lacked research competencies. Al-Said (2019) also highlighted the importance of exploring postgraduate students' training needs for research skills. Omar and Al-Omar (2020) pointed out that the acquisition of MA students of research skills was not adequate, and they made some suggestions based on their study findings such as training students to write research proposals, conducting training courses to teach students research skills, adding the practical side especially of statistical data analysis and drawing students' attention to common grammatical mistakes.

Al-Salim and Awadh (2016) believe there were weaknesses in research proposals, and they suggested organizing training courses to develop research proposal skills and improve students' research skills. Abu Al-Majd and Al-Arfaj (2017) suggested five main fields under which a number of skills came: academic skills, thinking skills, technological skills, life skills and information source identification skills. Al-Arqan and Al-Jarywi (2018) examined the role of training courses in developing research skills. Their study emphasized the importance of training courses in developing students' research skills and recommended training faculty to train students in research skills.

Emelyanova, et al (2017) pointed out the importance of teaching students research skills through academic courses. They also found out that what impeded students from pursuing postgraduate studies was their lack of research skills. They also believed that research skills could be developed through courses or providing students with previous research. In the light of the findings of the above studies, there seems to be a need for an accurate scale that measures the degree to which university students have research skills and identify the real levels of students' possession of these skills which are the goals of the current study.

## **Research questions**

The study seeks to answer the following questions:

1. What is the component structure of the research skill scale of Omani university students?

2. What are the validity indicators of the research skill scale of Omani university students?
3. What are the reliability indicators of the research skill scale of Omani university students?

## **Research objectives**

The present study aims to achieve the following objectives:

1. To identify the component structure of the research skill scale;
2. To check the validity indicators of the research skill scale;
3. To check the reliability indicators of the research skill scale.

## **Significance of the study**

The theoretical importance of this study lies in building a research skill scale which has good psychometric properties. The practical importance lies in the fact that this study will help researchers and various educational institutions benefit from the research skill scale and apply it to the different groups to check whether or not the groups have research skills.

## **Definition of terms**

Research skills: Al-Arqan and Al-Jaryawi (2018) define them as steps taken by researchers through the use of a research approach in choosing the research problem, their varied readings, formulating the research hypotheses, designing the research proposal, collecting, analyzing and discussing data and finally writing the research.

In this study, they mean procedurally the level of research skills which must be possessed by students and are represented in the items of the research skill scale.

Psychometric properties: These are the statistical competencies of the scale and include validity and reliability measures (Al-Abri, 2014).

## **The concept of research**

In his book, Hamami (1996) defines research as “a number of activities which attempt to add new basic skills to one or more fields of knowledge through exploring new significant facts by using methodological and objective processes and methods”. Badawi (1986) defines research as “the means by which a fact or a group of facts can be reached in a situation and an attempt to test it to check its soundness in other situations and generalize it to become a theory which is every researcher’s aim”.

Abu Al-Majd and Al-Arfaj (2017) define research skills as “postgraduate students’ excellence and mastery of using research tools, ability to analyze, make inferences and make decisions and utilization of information to solve a problem as per their knowledge and experience”. Abdulraouf (2010) defines research as “an organized specific and guided mental activity done by someone called a researcher to study a specific problem”.

## **Research skills which every researcher must have**

The following are some of the most important skills which researchers must have according to one statistic (Alyan & Ghunaim, 1999):

1. The title: it must be void of any mistakes, relate to the content and clarify the most important variables of the research.
2. The proposal structure: the elements of the proposal must follow a logical order and take into consideration the coherence of paragraphs, and the connection of the objectives with the problem. The research problem must be presented clearly in the proposal. The introduction must be appropriate for the topic. The research questions and hypotheses must be formulated precisely. The objectives should be linked to the problem and the significance of the research must be provided. In-text citations should be accurate and in-text sources and references should match. The reference list should be accurate.
3. Research methodology: The statistical method used should be suitable for the research questions and hypotheses. The research methodology used should be suitable as well.
4. Population and sample: the study population should be identified precisely, the sampling technique should be suitable and the sample size should be suitable for the research methodology.
5. The proposal language: the proposal should be free of any grammar and spelling mistakes and punctuation marks should be used correctly.
6. Research instruments: the research instrument should be suitable for the research topic and a valid and reliable instrument should be chosen correctly.

Statistics indicate that the level of students' mastery of research skills in the items of "topic and research instruments" is high, while it is low in the item of "proposal structure".

In his analytical study of a research methodology book, Dahlan (2020) refers to three main fields which have 18 sub-skills. These are as follows:

The first field is entitled "The research framework" and includes six sub-skills which are: the research topic, the problem, an introduction, hypotheses, variables and previous studies.

The second field is entitled "Research procedures" and includes six sub-skills which are: the sample, the population, the tools, validity, reliability and statistical processes.

The third field is entitled "Findings and documentation" and includes six sub-skills which are: discussion of findings, recommendations, suggestions, referencing, the abstract and the research report.

## **Literature review**

Al-Asmari and Al-Shehri (2021) conducted a study that aimed to identify the degree to which the postgraduate students at the College of Education at University of Bisha had metacognitive thinking skills from their perspective and their teachers' perspective. The researchers used a descriptive approach and a questionnaire as their data collection tool. The questionnaire consisted of 37 statements targeting the postgraduate students and their teachers. Its validity and reliability were confirmed. The study sample consisted of all the MA students enrolled in the first semester of the academic year 1441 AH who were 105 male and female students in addition to their teachers who were 36. The findings showed that the students had metacognitive thinking skills to a high degree from their perspective and to a fair degree from their teachers' perspective. The findings revealed statistically significant differences in the level of metacognitive thinking ascribed to the variables of the year of study and the type of program. The study concluded with a number of recommendations most important of which

was that the focus of thinking skills should be especially on metacognitive thinking skills when preparing a postgraduate program and its courses.

Al-Inizi and Al-filhawi (2018) carried out a study which aimed to explore the importance of e-learning to the acquisition of research skills from the point of view of BA students and postgraduate students in Kuwait. The researchers used an analytical, descriptive approach, and the study instrument was a questionnaire consisting of 40 items distributed randomly to a sample of 315 male and female students at the College of Primary Education at the Public Authority for Applied Education and Training. The findings showed the BA and postgraduate students had research skills to a fair degree. There were statistically significant differences ascribed to the variables of gender and study stage. The study recommended holding training workshops for faculty on research skills and e-learning.

Al-Mahfoudh and Al-Shamalti (2018) conducted a study which aimed to identify the degree to which Islamic education teachers at primary schools had necessary teaching competencies from the perspective of educational supervisors and school principals in Saudi Arabia. The study sample consisted of 18 primary school principals at Asir Directorate of Education and 10 educational supervisors of the Islamic education course. Their feedback on the degree to which Islamic education teachers at primary schools had necessary teaching competencies was taken through an observation card designed in the second semester of the academic year 1438 – 1439 AH for this purpose. The study followed a descriptive approach which was interested in describing the degree to which Islamic education teachers at primary schools had necessary teaching competencies. The study findings showed that Islamic education teachers at primary schools had necessary teaching competencies in some personal traits to a fair degree with a mean of 4.32. The mean of the extent to which teaching competencies of the second item were available to the educational supervisors in general was 3.98 to a high degree. The mean of the extent to which teaching competencies of the third item were available from the perspective of the educational supervisors in general was 3.88 to a high degree. The mean of the extent to which teaching competencies of the fourth item were available from the perspective of the educational supervisors in general was 3.83 to a high degree. The mean of the extent to which teaching competencies of the fifth item were available from the perspective of the educational supervisors in general was 3.93 to a high degree. The mean of the extent to which teaching competencies of the sixth item were available from the perspective of the educational supervisors in general was 3.93 to a high degree. There were no statistically significant differences between the means of the degree of school principals and educational supervisors with regard to which primary school Islamic teachers in Saudi Arabia had teaching competencies in all the instrument items.

Al-Haj et al (2018) carried out a study to identify the degree to which the students of Special Education Department at Al-Majmaa University had research skills from their perspective. 62 male and female students took part in the study. A questionnaire with 14 main items that included 68 sub-items was used. The findings showed that the degree to which the students had research skills was at level 70.05, and that there were statistically significant differences in the degree to which the education students at Al-Majmaa University had research skills from their perspective at 0.05 according to the cumulative average.

Akuegwu and Nwiue (2018) conducted a study to evaluate the possession of postgraduate students in Cross River in Nigeria of research skills. A descriptive approach was used. The study sample consisted of 300 male and female students. The findings showed that the students had research skills to a low degree. There was a big difference in the degree of their possession of

research skills as per the gender variable in favor of the male students. The study recommended providing students with research skills through participating in research-related activities.

These studies highlight the necessity of checking the degree to which university students have research skills. They showed differences in the possession of these skills. The researchers of the present study could not find any study on the component structure or psychometric properties of scales used in the above-mentioned studies to the best of their knowledge. Therefore, this study is different from the previous studies in its general goal which is to examine the component structure and psychometric properties of an important scale which is the research skill scale. It is also considered the first study, as far as the researchers know, in Sultanate of Oman in general and in A'Sharqiyah University in particular.

## **Research methodology**

In light of the study objectives and questions, this study uses the analytical, descriptive approach.

## **Study population and sample**

The population of the study included 5800 students at A'Sharqiyah University. A random sample of 400 male and female students was chosen. This sample is considered representative of the population according to Morgan (1970) and represents 7% of the population.

## **Study instrument**

The research skill scale prepared by Al-Musawi (2011) was used, and it included research skill competencies. It consisted of 30 items.

## **Scale validity and reliability**

Al-Musawi (2011) checked the scale validity and reliability. She checked its face validity and had it reviewed by a number of reviewers. She also calculated its reliability by using Cronbach Alpha coefficient whose value was 0.084. The reliability of the items ranged between 0.78 and 0.93. These are high reliability coefficients.

## **Statistical methods used in the study**

The following statistical methods were used:

- Exploratory factor analysis represented in the following tests: Skewness values and Kurtosis values, the Kaiser-Meyer-Olkin (KMO) Test, Bartlett's test, identifying the number of coefficients using Eigen values and Cattell's indicator and Varimax coefficient rotation.
- Pearson's coefficient correlations between the items and the overall degree of the scale.
- Cronbach Alpha coefficient to calculate reliability, Spearman-Brown coefficient and Guttman reliability coefficient.

## Results and Discussions

Findings on the first question:

What is the component structure of the research skill scale of Omani university students?

The normal distribution of data was checked through Skewness and Kurtosis values. The Skewness value was 0.069, and the Kurtosis value was -0.986. These values refer to the normal distribution of data as the reference values of proper Skewness should be between 2 and -2, and the proper Kurtosis values should be between 1,96 and -1,96 (George & Mallery, 2010) as quoted in Al-Sarairah (2019).

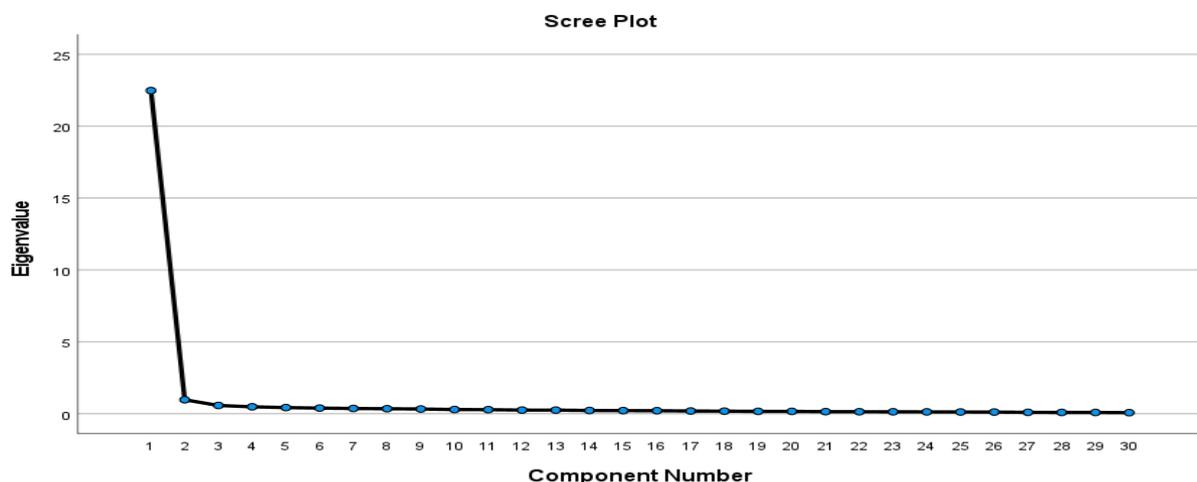
The suitability of the sample size for the possible use of the exploratory factor analysis (EFA) was also checked. The Kaiser-Meyer-Olkin (KMO) Test value was 0.980 which is acceptable and falls within the right range. Alawna (2019) points out that KMO values are perfect if they exceed 0.9. Bartlett's test value was 16757.067 with freedom degrees of 435 which are statistically significant at a significance value less than 0.01. This confirms the suitability of the correlation matrices among the variables. The exploratory factor analysis was used to check the component structure of the students' research skill scale. Besides, the principal component analysis was used to extract the scale components. The findings indicated the existence of one component whose Eigen value exceeded the whole. Its Eigen value was 22.478 and is interpreted as 74.925% of the overall variance of the items. This is a high value which indicates the reliability of this component and its ability to represent the scale. The saturations of the items in the one-component scale were calculated while taking into account that the fundamental saturation yardstick of the item with the component should be greater than, or equal to, the absolute value of 0.03. Table (1) illustrates these saturations.

**Table (1)** *Saturation values of the one-component research skill scale*

NO	Item	Saturation coefficient
1	Choosing a potential research problem which is new, important, worth studying and has practical applications in the educational field.	.839
2	Formulating and identifying the study problem which has been chosen clearly and precisely so that it is clear how the problem will be measured and what its feasibility is.	.869
3	Formulating the study questions and hypotheses correctly.	.875
4	Mastering research ethics.	.868
5	Identifying the study objectives and significance.	.866
6	Deciding on the appropriate research design.	.853
7	Identifying the research procedures and limitations.	.869
8	Clarifying the main terminology and variables.	.880
9	Being able to use traditional and electronic data bases.	.863
10	Being able to summarize the main points in the primary and secondary sources which are related to the study problem.	.860
11	Analyzing previous studies related to the study problem logically and consistently.	.873
12	Identifying the position of the study in relation to the other studies based on a review of the relevant educational and psychological literature.	.874
13	Being able to to classify previous studies into topics.	.868

14	Being able to comment on previous studies.	.876
15	Choosing an appropriate sample that represents the target population of the study.	.877
16	Designing an appropriate data collection tool based on the nature of study and kind of research approach followed.	.873
17	Checking the psychometric properties of the study tools.	.881
18	Applying the study tools which have been designed to the research sample in unified conditions.	.875
19	Having the skill in statistical programs.	.846
20	Organizing the findings in line with the sequence of the research questions.	.875
21	Analyzing the research findings logically through linking them with the main findings of the previous studies.	.877
22	Determining the extent to which the research findings can be generalized to appropriate populations.	.871
23	Presenting the conclusions and inferences in light of the main findings concisely and precisely.	.860
24	Choosing the research recommendations and suggestions in a procedural and specific way.	.861
25	Using a sufficient number of references which cover all aspects of the study problem.	.843
26	Using primary original sources which were the first to address the problem consistently.	.873
27	Documenting the sources used in the research in a list of references using APA referencing style.	.845
28	Organizing all parts of the research report correctly and clearly inside the research.	.864
29	Presenting my personal point of view on the problem under study in an organized way.	.845
30	Avoiding grammar mistakes and typos in the research.	.868
Eigen value		22.478
Percentage of interpreted variance		74.925

Through Cattell's curve in Figure (1) Scree plot which is related to the distribution of Eigen value of the components, it is clear there is only one component in the scale. The curve starts descending directly after the first component.



**Figure (1)** Cattell's curve for identifying the number of components

Findings on the second question: What are the validity indicators of the research skill scale of Omani university students?

To answer this question, validity was calculated in different ways. Face validity was calculated when the scale was reviewed by ten reviewers from A'Sharqiyah University, Sultan Qaboos University and the Ministry of Education. There were no major changes in the scale items, and the reviewers agreed on the scale validity in general. The minor changes in some items were implemented. Validity of internal consistency was also identified through calculating the correlation coefficients of the overall degree of the scale without the items themselves, and they were high coefficients and ranged between 0.827 and 0.872. This confirms what the scale is intended to measure which is research skills. The results of the exploratory factor analysis which were made clear in the findings on the first question confirm that the scale had high construct validity.

### **Findings on the third question**

What are the reliability indicators of the research skill scale of Omani university students?

To answer this question, reliability was identified using different methods. First, Cronbach Alpha coefficient was calculated. The findings showed that the research skill scale had a high reliability coefficient as Cronbach Alpha coefficient was 0.988. The findings of the reliability of Cronbach Alpha confirmed the coherence, connectedness and consistency of the scale items when the items were deleted from the scale because no value of any item increased when the scale was deleted. The reliability coefficient was calculated using the split-half method by dividing the scale into two halves. Spearman-Brown coefficient was 0.962, and Guttman's coefficient was 0.962 as well, which are high reliability coefficients. This confirmed the reliability of the scale items.

### **Conclusion**

In the light of the findings, it can be inferred that the research skill scale of the Omani students had a good component structure and appropriate psychometric properties which make it able to validate the degree to which university students have research skills.

### **Recommendations and suggestions**

In the light of the findings which the researchers have arrived at, the following can be recommended:

- The research skill scale should be used to measure the level at which Omani students at various Omani universities have research skills;
- Confirmatory factor analysis should be conducted to measure university students' research skills to examine its goodness of fit;
- Other studies on the component structure of other scales measuring research skills should be conducted to check the findings which the present study arrived at in this respect.

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