DEVELOPMENT AND STANDARDIZATION OF POSTGRADUATE STUDENTS' CREATIVITY SCALE

[1]Nkechi Patricia-Mary Esomonu (PhD), & [2]Chukwuemeka Benedict Ikeanumba (PhD)

[1&2]Department of Department of Educational Foundations, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

[1]nkechipmesomonu@gmail.com & [2]chukwuemekaikeanumba@gmail.com

Abstract

The study developed and standardised a scale for measuring the Postgraduate Students' Creativity Scale (PSCS). This study aimed to develop, validate and standardise a creativity scale for postgraduate students. The study employed an instrumentation design in which a four-point scale was developed and standardised. An initial draft of a 56-item instrument was developed and standardised. After corrections, a 51-item instrument emerged and was administered to 500 postgraduate students. The data collected were subjected to factor analysis. The results from factor analysis showed that 30 items loaded well on five factors, with a minimum loading of 0.54. The 30 items were administered to 600 students to establish norms. The norm for the entire instrument was 63.65; the norms of male and female students were 36.10 and 40.01, respectively. Cronbach's alpha statistic was used to assess the reliability of the instrument, yielding an internal consistency of 0.82 for the 30 items. Hypotheses were tested using t-test statistics; the result shows that there is a significant difference between the norms of male and female students. The manual of the PSCS outlines the administration and scoring procedures of the scale, as well as its psychometric properties. The instrument PSCS is therefore recommended for assessing the creativity of postgraduate students.

Keywords: Instrumentation, Creativity, Standardisation, Postgraduate, Students, Scale

1. Introduction

University education is a higher educational programme where secondary school, college and polytechnic leavers attend to further their academic programme for the acquisition of higher knowledge, competencies, and self-reliance, enabling them to handle life's challenges. It is a place where people of diverse backgrounds are guided and directed to produce high-skilled individuals, resulting in research output that achieves predetermined goals. Also, postgraduate students tend to exhibit different behaviours than those who have completed secondary and primary educational levels. It is at the university that the degree certificates are awarded at various academic stages, such as First Degree (BSC or B.Ed or BA or B.Eng), Master's Degree (M.Sc, MA, M.Ed, and others) and Doctor of Philosophy Degree (PHD), depending on the individual student's level of programme.

The university, as viewed by Bridge (2013), is an institution that produces graduates in a wide range of professions, spanning from teaching and learning to diverse areas. In other words, it offers higher education with large expectations in different nations, and this diversity exposes

students to various thinking approaches. In support of the above assertion, Southern Utah University (2016) views the university as an institution of people who require higher learning, which is facilitated by running various programs and studying numerous courses in research facilities that may prompt them to perceive construct in the manner they think it can be executed. The university, as an institution, is a place where people are nurtured in developing current concepts and eliminating obsolete knowledge that may contribute to the reduction of individual and national growth and development.

Concerning the purpose of establishing a university, Kwok (2015) reported that the primary purpose of a university is to broaden the mindset and horizon of students, thereby enhancing their ability to relate to issues and carry out adequate analysis of problems, ultimately facilitating the successful modification of society. On the contrary, Morrish (2015) noted that the enlargement of students' mindset and horizon is not the only reason for the establishment of a university, but rather for the individual and the nation at large. The researcher added that if students are trained accordingly to what the university intends, they will understand the relationship between apparently disparate phenomena, such as the acquisition of independent knowledge and the development of their competencies, as well as the challenges that may confront them in life as future leaders. Following the above assertions, students, such as postgraduate students, may be independent individuals who have individual responsibilities to be creative in various dimensions, including organising and solving challenges in academic studies. Therefore, there is a need for them to advance in their creativity rationally, socially, scientifically, morally, and otherwise; hence, the process of bringing new things or ideas into existence may be referred to as creativity.

Creativity can be defined as the capacity to generate products with originality and value (Romo, 2019). Creativity is a skill essential for employees to initiate the developmental process (Sheikh & Rana, 2021). It plays a vital role in adopting new skills for life, receiving professional grooming, and facilitating effective communication and collaboration (Bellanca & Brandt, 2010). Creativity is the ability to produce or develop original work, theories, techniques, or thoughts. A creative individual typically displays originality, imagination, and expressiveness. Creative thinking refers to the mental processes leading to a new invention or solution to a problem. It stimulates a student's problem-solving ability, paving new ways to success and making them more confident (Sheikh & Rana, 2021). Creativity, as viewed by Zhou, Wang, Bavato, Tasselli, and Wu (2019), is a characteristic of an individual or a process that generates something new and valuable. The created item may be intangible (such as an idea, a scientific theory, a musical composition, or a joke) or a physical object (such as an invention, a printed literary work, a painting, or a project writing). It is the production of something original or worthwhile. Creativity empowers students to explore and learn from one another. As they overcome challenges and bring their creative ideas to fruition, students begin to see that they have limitless boundaries. That, in turn, creates confidence. It enhances self-esteem and emotional development, which are essential for an individual's overall well-being (Krueger, 2022). This aligns with the 5Ps of creativity, as outlined by Schordine (2013), which are perception, practice, perseverance, patience, and passion.

Moreover, Krueger (2022) emphasised the importance of creativity, highlighting its role in motivating students to learn, stimulating brain activity, fostering emotional development through trial and error, engaging hard-to-reach students, and being an essential job skill of the future. This aligns with the work of Muller (2019), who outlines the characteristics of creative students as including flexibility, intense curiosity, a positive attitude, strong motivation and determination,

and fearlessness. This was supported by Bokhari's (2023) contribution, which suggests that creative students are curious, imaginative, persistent, flexible, and open-minded. In addition, creativity is so important that Sternberg in Muller (2018) outlined the components/levels of creativity to include expertise, imaginative thinking skills, a venturesome personality, intrinsic motivation, and a creative environment that sparks, supports, and refines creative ideas. Marijana (2021) supports the above-mentioned five domains of creativity, which include self/everyday, scholarly, performance, mechanical/scientific, and artistic. Each dimension of creativity is associated with tasks that people can encounter and solve in creative ways. The Self/Everyday domain encompasses all tasks that people encounter in daily life, such as finding the best solution to a problem or creatively assisting others. The Scholarly domain includes activities that involve analysing and discussing topics or conducting other activities related to academia, such as providing constructive feedback on a scientific paper. Activities in the Performance domain can be performed in front of an audience or shared with one, such as playing an instrument, writing a poem, dancing, and other forms of public performance. The Mechanical/Scientific domain encompasses activities that require an interest in and knowledge of STEM disciplines, such as computer programming and building mechanical devices. Finally, activities such as sketching people or objects and making a sculpture belong to the Artistic domain.

The students have the benefit of reflecting on their personal knowledge and information given to them as it relates to assignments, research and tests they have to write. It also helps them to be open-minded and informed, increasing their ability to evaluate and judge issues based on evidence, which can aid in writing a productive essay and efficiently writing papers that can be generally accepted without bias. With creative ability, students can develop self-discipline, self-monitoring, and self-corrective thinking constructs, among others. As students think creatively, they communicate effectively when analysing any concept and can always provide a solution to problems with adequate involvement in making it a real-life situation.

Despite the relevance and importance of creativity in different perspectives, various challenges confront the postgraduate students in their creativity ability, which, among others, include a lack of direction from oneself or others, being afraid of failure, being afraid of rejection, never changing or adapting to the situation, not thinking proactively, as well as rationalising and never improving. However, to overcome these challenges, it is necessary to construct/develop a practical and useful creativity scale that will possess the characteristics of how postgraduate students should be creative in order to realise their aim of attaining higher educational programmes.

Scale development, as described by Tay and Jebb (2017), is a process of creating a reliable and valid measure of a construct to assess an attribute of interest. In the same vein, Dorathy, Amadioha, and Orluwene (2021) viewed scale development as a systematic process of generating items for assessing a construct under study. Dorothy went further to say that it requires writing where the researcher can realise the scale and consideration of theories for the basis of item development, which can also be put in place during the execution of the study. In that regard, Bruns and Hynes (2015) summarised that scale development involves different requirements of guiding principles. Systematically, scale development requires various procedures to accomplish the task. This can be achieved by first considering the type of item to develop, indicating the domains from which it can be written, to ascertain the validity of the content through the transformation of each item into a meaningful construct. In support of this, Esomonu and Okeaba

(2021) outlined the procedures for scale or instrument development to include; initial steps, test blue print, item generation, preliminary validation, pilot testing (Optional), content validity index (Optional), trial testing, item analysis, good item selection (which involves G theory/D study and content validity index), convergence estimation, final testing, and norming and publication. In light of the above, Wright, Quick, Hannah, and Hargrove (2017) asserted that an adequately developed and validated scale provides the vital basis for establishing qualitative research, as the best application of scale construction was recommended.

To develop a valid and accurate scale, it is necessary to validate the instrument. Scale validation is the extent to which an instrument or scale indeed measures the latent dimension or construct it was developed to evaluate or measure. Scale or instrument validation, as viewed by Dorathy (2021), is the process of determining the degree to which the scale measures what it is supposed to measure. Scale validation can also be referred to as the comparison of the construct to the criterion, as criterion validity is one of the means of validating a scale. In line with this, researchers have also considered validating the scale at various stages of the development process. This led to Collindge (2014) assertion that scale instrument can be validated by face validity as the physical appearance of the items are generally accepted, pilot testing it with a different sample from the intended sample of the study and after which analysis of the data are executed to ensure its validity and reliability to be used for the study and to check the measurable factors covariance components errors and so on. Instrument validation is the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform. To effectively develop a valid and reliable scale or instrument for assessing students' creativity, it is necessary to consider relevant theories that will best explain how the study's aim will be achieved systematically. There are various components of theories which a scale designer has to focus on in the development and execution of a scale, which includes among others; classical test theory CTT), item response theory (IRT) also known as latent test theory, generalizability theory or G-theory (GT) and factor analysis (FA) which falls under the context of classical test theory.

Factor analysis (FA) enables us to simplify a set of complex variables or items using statistical procedures to identify the underlying dimensions that explain the relationships between multiple variables/items. A simplification of a matrix of correlations allows a researcher to more easily understand the relationship between items in a scale and the underlying factors that the items may have in common. FA is a commonly applied and widely promoted procedure for developing and refining educational assessment instruments to produce evidence for the construct validity of the measure (Tavako & Wetze, 2020). Factor analysis is of two types: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Confirmatory factor analysis is a theory or model-driven approach that tests how well the data fit to the proposed model or theory. CFA thus departs from EFA in that researchers must first identify a factor model before analysing the data. More fundamentally, CFA is a means for statistically testing the internal structure of instruments and relies on the maximum likelihood estimation (MLE) and a different set of standards for assessing the suitability of the construct of interest.

Despite the importance of using factor analysis in determining the quality and construct validity of a scale, such as a creativity scale, to improve the quality of learning, teaching, and assessment, there seems to be a limited number of creativity scales available to the public that serve these purposes (Alderson, 2007). Enyia (2023) researched the development and validation of a creativity assessment scale among senior secondary school students with hearing impairments

in the Ibadan metropolis. Zhao, Gao, Zhao, and Luo (2021) conducted a study on the development of the Short Creative Expression Interest Scale based on item response theory in China. Sheikh and Rana (2021) conducted a study on the development of a scale to measure teachers' creativity in Pakistan. Penagos-Corzo and Saucedo (2021) researched the development and validation of a questionnaire to assess creative potential traits in Mexico. Thus, there is a limited creativity scale available for postgraduate students, and to the best of the researcher's knowledge, there is a paucity of empirical studies on the creativity ability of postgraduate students using factor analysis. The steps and stages involved in constructing the creativity scale posed a massive problem for the psychometrician and researcher.

Mawaddah and Duskri (2018) observed a gender difference in creativity. According to the researchers, gender differences certainly cause physiological differences, as well as affect psychological differences in learning, resulting in differences in learning between male and female students. Ekawati and Wulandari (2011) held the view that males and females are psychologically different. Females tend to be more interested in real-life issues, whereas males are more inclined towards abstract aspects. In support of this, Krutetskii in Mawaddah and Duskri (2018) asserted that the difference between males and females in learning is that males tend to be superior in reasoning. In contrast, females tend to excel in accuracy, precision, carefulness, and thought-motivatedness. This made it necessary to fill this gap by developing and standardising a creativity scale for postgraduate students in Nnamdi Azikiwe University, Awka. This study aimed to develop, validate and standardise a creativity scale for postgraduate students in Nnamdi Azikiwe University, Awka, using factor analysis. The following research questions were formulated for the study.

1. How valid are the items of the scale for postgraduate students' creativity (PSCS) in terms of their factor loadings?
2. What is the reliability co-efficient of the scale for postgraduate students' creativity scale (PSCS) using Crombach Alpha?
3. What are the norms for interpreting the scores of the postgraduate students' creativity scale (PSCS)?
4. What are the norms for interpreting the scores of each dimensions or sub-scale of postgraduate students' creativity scale (PSCS)?

1.2 Hypotheses
The following null hypotheses were tested at 0.05 level of significance:
1. The norm of males and females in the PSCS do not differ significantly.
2. There is no significant difference between the norms of the male and female students in the self/everyday section of the PSCS.
3. The norms of the male and female students in the scholarly section of the PSCS do not differ significantly.
4. The norm of males and females do not differ significantly in the performance section of the PSCS.
5. The norm of males and females do not differ significantly in the mechanical/scientific section of the PSCS.

6. The norm of males and females do not differ significantly in theartistic section of the PSCS.

2. Materials and Methods

The study adopted an instrumentation research design. A study belongs to instrumentation research if it involves introducing new or modified content, procedures, technology, or instruments in educational practice (Ogoamaka in Esomonu and Okeaba, 2016). Esomonu and Okeaba (2016) pointed out that a study geared towards the development and standardisation of instruments in education is an instrumentation study. This study involved the development and standardisation of an instrument for assessing the creativity of postgraduate students. The study was conducted in the South East of Nigeria. South-eastern Nigeria is one of the six geopolitical zones in the country. The South East States of Nigeria comprises Anambra, Abia, Ebonyi, Enugu and Imo States. The population of the study comprised 12,367 postgraduate students from all government-owned universities in South East Nigeria for the 2022/2023 academic session. The sample size of the study comprised 172 postgraduate students (MSC and PhD) from the Faculty of Education at Nnamdi Azikiwe University, Awka, Anambra State, and 212 postgraduate students (MSC and PhD) from the University of Nigeria, Nsukka, Enugu State. The researcher used purposive sampling to select two federal government-owned universities out of the ten federal government-owned universities in the five states in the South East, Nigeria, for the study.

2.1 Instrument Development Process

1. **Pool of attributes/item generation:** At this stage, a preliminary draft was constructed based on the various indicators of creativity. The draft will have 56 items.
2. **Organisation of Items:** The draft instrument, comprising 56 items covering the five indicators of creativity, was divided into six parts. The first part is the biodata of the respondents. In contrast, the 2nd, 3rd, 4th, 5th, and 6th parts sought information on the creativity of postgraduate students based on self-every day, scholarly, performance, mechanical/scientific, and artistic contexts, respectively.
3. **Preliminary Validation of the Instrument:** The draft of the instrument underwent face and content validation by experts in educational measurement and evaluation. These experts were tasked with evaluating the relevance, adequacy, and comprehensiveness of the instrument's items. To guide the experts in the validation exercise, the topic of study, purpose of the study, research questions, and hypotheses, together with the draft instrument, were provided to the experts.
4. **Assembling the initial draft instrument:** corrections, comments, and experts' observations were incorporated into the modification of the instrument, if necessary.
5. **Construct Validation:** After face validation, the validated instrument was administered to 300 postgraduate students from other universities in the southeast, who are different from those being studied, to establish construct validity. Therein, the items were subjected to factor analysis.

Exploratory Factor analysis will be used to address research question one, and Cronbach's Alpha statistic will be used to answer research question two. Research questions three and four will be answered using mean deviation and standard deviation. For the hypothesis, a t-test was used to compare the difference between two means. All data were analysed using the Statistical Package for the Social Sciences (SPSS version 25.0).

3. Results

The data tested for suitability, EFA via Principal Axis Factoring using Varimax rotation was perform on the 56 items. Criteria that is often used to determine factorability of variables was applied in this analysis. These initial factorability criteria included examination of the following: (1) bivariate correlations, (2) Kaiser-Meyer-Olkin measure of sampling adequacy, (3) Bartlett's test of sphericity, and (4) Anti-image correlation. Bivariate correlation shown that there are some variables that have more than .3 correlation coefficient. On the overall Kaiser-Meyer-Olkin measure of sampling adequacy was .87, larger than the recommended value of .50. In addition, Bartlett's test of sphericity was statistically significant [$\chi 2$ (1416) = 2202.348, p <.001]. Five factors were extracted, the F1 account for 39.43% variance, the F2 account for 16.14% variance, the F3 account for 10.11% variance, the F4 account for 8.5% variance and the F5 account for 3.75% variance. The five factors collectively account for 77.93% variance.

Research Questions 1: How valid are the items of the scale for postgraduate students' creativity (PSCS) in terms of their factor loadings?

The construct validity of the scale based on loadings of the items per factor are presented in table 1 for discussion. Items with bold surface in table have loadings above .45 (Kline, 2016). Principal Axis factoring via Varimax Rotated Factor Loadings of the Items of scale for postgraduate students' creativity (PSCS).

Table 1: Factors loading in their Respective Factor

	F1	F2	F3	F4	F5	Communalities
ITEM1	**.582**	.203	.026	.036	.001	.236
ITEM2	**.665**	.092	.010	.057	.049	.334
ITEM3	.034	.244	.020	-.081	-.086	.453
ITEM4	**.604**	.032	.004	-.020	.022	.373
ITEM5	**.703**	.036	-.029	.108	.001	.399
ITEM6	**.608**	.293	.034	-.028	.005	.387
.ITEM7	**.594**	.018	.021	.052	.040	.397
ITEM8	**.581**	.105	.017	-.109	.020	.387
ITEM9	.178	.224	-.042	.080	.097	.356
ITEM10	.247	.237	-.003	.053	.004	.259
ITEM11	**.836**	.141	-.035	.035	.034	.314
ITEM12	.232	.213	.076	-.071	-.191	.179
ITEM13	.028	.322	.074	-.012	-.006	.398
ITEM14	.328	.249	.014	.070	.111	.323
ITEM15	.214	.101	-.093	-.106	.011	.234
ITEM16	.109	.008	.018	-.056	.061	.390
ITEM17	.119	.212	-.001	.020	.036	.396
ITEM18	.218	.150	.028	.081	.038	.312
ITEM19	.100	**.599**	.083	.011	.002	.371

Item						
ITEM20	.107	**.666**	.080	.010	.108	.376
ITEM21	.043	.154	-.050	-.016	.003	.311
ITEM22	.206	**.754**	.016	-.004	.003	.375
ITEM23	.012	**.679**	.016	.025	.007	.328
ITEM24	.030	.246	.027	.003	.058	.204
ITEM25	.105	**.632**	.100	-.028	-.015	.369
ITEM26	.228	**.722**	.020	.011	.003	.030
ITEM27	.113	**.502**	-.002	.199	-.015	.221
ITEM28	.006	.012	.103	.054	.095	.355
ITEM29	.023	-.092	.170	-.077	.058	.345
ITEM30	.007	-.101	.267	-.088	-.086	.149
ITEM31	.105	-.010	.160	-.038	-.119	.340
ITEM32	-.010	.102	.250	-.021	.001	.114
ITEM33	.039	-.052	**.541**	.014	.053	.300
ITEM34	-.101	.142	.224	.015	-.008	.106
ITEM35	.100	.125	**.595**	.013	.104	.427
ITEM36	.014	.010	**.581**	.104	.041	349
ITEM37	.041	.016	**.643**	.001	.107	.320
ITEM38	-.149	.081	**.843**	.026	.223	.276
ITEM39	-.178	.153	.119	-.036	.091	.240
ITEM40	.020	.017	**.616**	.016	.012	.385
ITEM41	.026	-.008	.305	.042	-.051	.261
ITEM42	.209	.161	.057	**.746**	-.125	.399
ITEM43	.101	-.080	.183	**.663**	-.098	.278
ITEM44	-.025	.032	.260	**.826**	-.029	.133
ITEM45	-.260	.085	.121	-.010	-.158	.203
ITEM46	.201	.348	.022	**.604**	.059	.178
ITEM47	.029	.029	.028	**.644**	-.012	.317
ITEM48	.023	.114	.074	.014	.002	.410
ITEM49	.007	.164	-.042	.008	-.021	.219
ITEM50	-.010	-.106	.125	.195	.108	.320
ITEM51	.124	.031	-.032	.091	.017	.171
ITEM52	.001	.043	.009	.261	**.630**	.223
ITEM53	-.009	.110	.112	.255	**.731**	.253
ITEM54	.117	.108	.020	.135	**.639**	.342
ITEM55	.023	.104	.006	.005	**.726**	.194
ITEM56	-.117	.016	-.029	.055	.053	.262

Table 2 shows the factor loadings for all the 30 items that were finally selected. Five (5) factors were extracted. Thirty (30) items loaded up to 0.45 and above (acceptable level for factor loading as stated by Kline, 2016) on five (5) factors. The table 2 also shows that 8 items that is, Item 1, 2, 4, 5, 6, 7, 8, and 11 loaded above .45 on factor 1 (self/everyday level). 7 items that is, Item 19, 20, 22, 23, 25, 26 and 27 loaded above .45 on factor 2 (scholarly level). 6 items that is, Item 33, 35, 36, 37, 38 and 40 loaded above .45 on factor 3 (performance). 5 items that is, Item

42, 43, 44, 46 and 47 loaded above .45 on factor 4 (mechanical). While 4 items, that is Item 52, 53, 54, and 55 loaded above .45 on factor 5 (Artistic).

Factor that had at least 4 factors items adequately loaded on them were acceptable as valid. This is in line with assertion of Esomonu and Okeaba (2016) stating that any factor with at least 4 items adequately loaded on it is valid. Hence a total of 30 items considered factorially pure and valid load on five (5) factors were selected to make final draft.

Table 2: Summary of the Factor Loading of the Surviving 30 Items of the Inventory

F	Items	Loading
1	1	.582
	2	.665
	4	.604
	5	.705
	6	.608
	7	.594
	8	.581
	11	.836
2	19	.599
	20	.666
	22	.754
	23	.679
	25	.632
	26	.722
	27	.502
3	33	.541
	35	.595
	36	.581

	37	.643
	38	.843
	40	.616
4	42	.746
	43	.663
	44	.826
	46	.604
	47	.644
5	52	.630
	53	.731
	54	.639
	55	.726

Research Questions 2: What is the reliability co-efficient of the scale for postgraduate students' creativity scale (PSCS) using Crombach Alpha?

The reliability of Creativity Scale for Postgraduate Students Questionnaire and its sub-scale dimensions were presented in table 3 for discussions.

Table 3 Reliability of the instrument and its sub-scale based on Cronbach Alpha

Scale Dimension	No of items	Items	Cronbach Alpha
F1	8	1, 2, 4, 5, 6, 7, 8, and 11	.71
F2	7	19, 20, 22, 23, 25, 26 and 27	.83
F3	6	33, 35, 36, 37, 38 and 40	.76
F4	5	42, 43, 44, 46 and 47	.71
F5	4	52, 53, 54, and 55	.86
Entire scale	30		.82

Table 3 shows the reliability of the overall scale as well as sub-scale dimensions of the construct. There are five sub-dimensions of the Creativity Scale for Postgraduate Students Questionnaire as revealed by result of the factor analysis. Cronbach alpha reliability coefficients for Creativity Scale for Postgraduate Students Questionnaire was calculated as 0.82 for the scale total score with 30 items, 0.71 for the sub-dimension 1 (everyday level) with 8 items, 0.83 for the sub-dimension 2 (scholar level) with 7 items. .76 for the sub-dimension 3 (performance) with 6 items .71 for the sub-dimension 4 (mechanical) with 5 items and .86 for the sub-dimension 5 (artistic) with 4 items.

Research Question 3: What are the norms for interpreting the scores of the postgraduate students' creativity scale (PSCS)?

The norms of the overall instrument are present in table 4 while norms for female and male respondents are present in table 5

Table 4: General Norms of Postgraduate Students' Creativity Scale (PSCS)

Mean	Variance	SD	No Items	N
63.65	78.81	8.98	30	600

Table 4 shows that the norm of the students' postgraduate students' creativity scale (PSCS is 40.65 since the mean performance of 600 students is 63.65

.
Table 5: The norms for female and male students postgraduate students' creativity scale (PSCS)

Sex	Mean	SD	No Items	N
Male	36.10	7.20	30	220
Female	40.01	8.20	30	380

Table 5 reveals that average score of male students on the postgraduate students' creativity scale (PSCS) is 36.10 while the average score of female students on the postgraduate students' creativity scale (PSCS) is 40.01.

Research Question 4: What are the norms for interpreting the scores of each dimensions or sub-scale of postgraduate students' creativity scale (PSCS)?

Table 6: Sub-scale norms of Postgraduate Students' Creativity Scale (PSCS)

Factor	Sub-scale	Mean	SD	No Items
F1	self/everyday	10.12	4.21	8
F2	scholarly	11.20	3.20	7
F3	Performance	15.21	4.23	6
F4	mechanical/scientific	13.11	2.40	5
F5	Artistic	12.33	4.44	4

Table 6 reveals the average performance of students in various part postgraduate students' creativity scale (PSCS). From the table 6, items related to factor 1 norm 10.12, items related to factor 2 norm 11.20, items related to factor 3 norm 15.21, items related to factor 4 norm 13.11 while items relating to factor 5 norm 12.33.

Hypothesis 1: The Norm of Males and Females in the PSCS will not differ Significantly.

Table 7: t- test of significance difference for norm for male and female students

Sex	Mean	SD	df	t	p-value	Remark
Male	36.10	7.20				
			1198	11.73	P<.001	S
Female	40.01	8.20				

Table 7 shows that there is a significant difference between the norms of male and female students in the postgraduate students' creativity scale (PSCS) (p<.001).

Hypothesis 2: There is no significant difference between the norms of the male and female students in the self/everyday section of the PSCS.

Table 8 t- test of significance difference for norm for male and female students for F1 sub-scale dimension

Sex	N	Mean	SD	df	t	P-value	Remark
Male	220	12.22	6.21				
				1198	13.108	P<.001	S
Female	380	14.30	5.21				

Table 8 shows that there is a significant difference between the norms of male and female students in the self/everyday section of postgraduate students' creativity scale (PSCS) (p<.001).

Hypothesis 3: The norms of the male and female students in the scholarly section of the PSCS will not differ significantly.

Table 9: t- test of significance difference for norm for male and female students F2 sub-scale dimension

Sex	N	Mean	SD	df	t	p-value	Remark
Male	220	8.27	4.31				
				1198	6.804	P<.001	S
Female	380	10.31	6.10				

Table 9 shows that there is a significant difference between the norms of male and female students in the scholarly section of postgraduate students' creativity scale (PSCS) (p<.001).

Hypothesis 4: The norm of males and females will not differ significantly in the performance section of the PSCS.

Table 10: t- test of significance difference for norm for male and female students F3 sub-scale dimension

Sex	N	Mean	SD	df	t	t-critical	Remark
Male	220	10.21	4.70				
				1198	12.011	P<.001	S
Female	380	13.32	5.02				

Table 10 shows that there is a significant difference between the norms of male and female students in the performance section postgraduate students' creativity scale (PSCS) (p<.001)

Hypothesis 5: The norm of males and females will not differ significantly in the mechanical/scientific section of the PSCS.

Table 11: t- test of significance difference for norm for male and female students F4 sub-scale dimension

Sex	N	Mean	SD	df	t	p-value	Remark
Male	220	11.22	5.13				
				1198	11.037	P<.001	S
Female	380	14.21	6.81				

Table 11 shows that there is a significant difference between the norms of male and female students in the mechanical/scientific section of postgraduate students' creativity scale (PSCS) (p<.001).

Hypothesis 6: The norm of males and females will not differ significantly in the artistic section of the PSCS.

Table 12: t- test of significance difference for norm for male and female students F5 sub-scale dimension

Sex	N	Mean	SD	df	t	p-value	Remark
Male	220	10.22	5.21				
				1198	4.008	P<.001	S
Female	380	12.11	7.17				

Table 12 shows that there is a significant difference between the norms of male and female students in the artistic section of postgraduate students' creativity scale (PSCS) (p<.001).

4. Discussion

Research question one: Table 2 presents the factor loadings for the 30 items that were ultimately selected. Five (5) factors were extracted. Thirty (30) items loaded up to 0.45 and above (acceptable level for factor loading as stated by Kline, 2016) on five (5) factors. Table 4.2 also shows that eight items loaded above .45 on factor 1 (self/everyday level). 7 items loaded above .45 on factor 2 (scholarly level). 6 items loaded above .45 on factor 3 (performance). 5 items loaded above .45 on factor 4 (mechanical). At the same time, four items loaded above .45 on factor 5 (Artistic). Factors with at least four items adequately loaded were considered acceptable as valid. This is in line with the assertion by Esomonu and Okeaba (2016), who state that any factor with at least four items adequately loaded on it is considered valid. Hence, a total of 30 items considered factorially pure and valid load on five (5) factors were selected to make the final draft.

Research question 2: Table 3 presents the reliability of the overall scale, as well as the sub-scale dimensions of the construct. The Creativity Scale for Postgraduate Students Questionnaire comprises five sub-dimensions, as revealed by the factor analysis results. Cronbach alpha reliability coefficients for the scale was calculated as 0.82 for the total score with 30 items, 0.71 for the sub-dimension 1 (everyday level) with eight items, 0.83 for the sub-dimension 2 (scholar level) with seven items 0.76 for the sub-dimension 3 (performance) with six items 0.71 for the sub-dimension 4 (mechanical) with five items and 0.86 for the sub-dimension 5 (artistic) with four items. Each of the factors is composed of more than 4 items, along with their corresponding factor loadings, except for factor 5, which aligns with Meredith's (1969) recommendation.

From Table 4, it is evident that the norm of the CSPSQ is 63.65; any score below the norm indicates low creativity, while scores above the norm indicate high creativity. Additionally, according to Table 5, the norms for males and females are 36.10 and 40.01, respectively. The difference in means of male and female students was subjected to a hypothesis test (see Table 7), and the result shows that there is a significant difference between the norms of the male and female students in the CSPSQ. However, the results from hypotheses 2, 3, 4, and 5 show that there is no significant difference between the norms of male and female students in the CSPSQ patterning for self/everyday, scholarly, and performance sections. In contrast, there is a significant difference between the sections of mechanical/scientific and artistic.

5. Conclusion

The 30-item CSPSQ underwent factor analysis with varimax rotation and loaded adequately on five factors: self/everyday level, scholarly level, performance, mechanical/scientific, and artistic. These five factors have high internal consistencies of 0.71, 0.83, 0.76, 0.71, and 0.86, respectively, and a general reliability of 0.82. With the above in view, the researcher concludes that the instrument (CSPSQ) is valid and highly reliable.

6. Recommendations

Based on the implications and findings of this study, the following recommendations are made:

1. University administrators should adopt the Postgraduate Student Creativity Scale (PSC) as a tool for measuring students' creativity.
2. Students should use the Creativity Scale for Postgraduate Students' Questionnaire (CSPSQ) for self-assessment.

3. Academic advisers and guidance counselors should adopt the CSPSQ as a diagnostic tool for assessing students' creativity.
4. Improving students' creativity should be pursued by collecting data using the CSPSQ as a tool for data collection.
5. University administrators should prioritize students' creativity by developing effective ways to foster it.

References

Bellanca, J. & Brandt, R. (2010). *21st century skills*: Rethinking how students learn

Bokhari, H. (2023). The five traits of creativity. https://www.coursesidekick.com/communications/332896

Bridge, L. (2013). *What is a university?* Top university. https://www.topuniversities.com/blog/what-university

Bruns, F. & Hynes. (2015). Scale development. Wiley online library. *https://online-library.wiley.com/doi/10.1002/9781118625392.wbecp186*

Collindge, D. (2014). *Validating a questionnaire*. https://www.methodspace.com

Dorathy, S., Amadioha, A., & Orluwene, G.W. (2021). Application of generalizability theory in the estimation of dependability of critical thinking scale for university students. *Scholars Journal of Physics, Mathematics and Statistics*, *8*(9), 171-178.

Enyia, G. A. (2023). *Development and validation of creativity assessment scale among senior secondary school students with hearing impairment, Ibadan metropolis*. https://www.researchgate.net/publication/371692441

Esomonu, N.P.M., & Okeaba, J.U. (2021). Development and Standardization of Inventory for Measuring Students' Integration into University Academic Culture. *European Journal of Educational Research*, *5*(4), 201-2011

Krueger, N. F. (2022). Competing models of entrepreneurial intentions. *Journal of Business Venturing, 15*(5–6), 411–432.

Kwok, S. (2015). *The purpose of a University Education*. South China monitoring post. Insight and opinion. https://www.Scmp.com/comment/insight-opinion/article/1889688/what-purpose.14/7/2015

Mawaddah, A., Ahmad, A., & Duskri, M. (2018). Gender differences of mathematical critical thinking skills of secondary school students. *Journal of Physics*, *1088*(1), 1-6

Morgado , F. F. R., Meireles , J. F. F. , Neves, C.M. , Amaral, A. C. S. & Ferreira , M. E. C. (2017). Scale development: ten main limitations and recommendations to improve future research practices. *Psicologia: Reflexao e Critica*, 30(1).

Morrish, H. (2015). *The telegraph, four reasons why university is still in existence* https://www.Telegraph.com.uk

Muller, D. R. (2019). *The five characteristics of creativity*. Medium. https://medium.com/@DrRobertMuller/the-five-characteristics-of-creativity-a872a333fb48

Penagos-Corzo, J.C., & Saucedo, A. (2021). Development and validation of a questionnaire to assess creative potential traits. *Front. Psychol*. 12:756079. doi: 10.3389/fpsyg.2021.756079

Romo M. (2019). *Psicologiìa de la Creatividad. PerspectivasContemporaìneas [Psychology of Creativity. Contemporary perspectives]*. Milano: Paidos.

Schordine, A. (2013). *The 5 Ps of the creative process*. https://theinspiredclassroom.com/2011/09/the-5-ps-of-the-creative-process/#:~:text=Allow%20me%20to%20introduce%20you,Perseverance%2C%20Patience%2C%20and%20Passion.

Sheikh, I. & Rana, R. A. (2021). Development of scale to measure teachers' creativity. *Journal of Development and Social Sciences*, 2(3), 306-319.

South Utah University (2016). *What is a university?*Suu/blog/t-bird nation. https://tbirdnation.suu.edu/what-is-a-university

Tavakol M, & Wetzel A. (2020). Factor Analysis: A means for theory and instrument development in support of construct validity. *International Journal Medical Education*, 6(11),245-247.

Tay, & Jebb, A. (2017). Scale development. In S. Regeberg (Ed.), *the SAGE Encyclopedia of Industrial and Organizational Psychology 2nd Ed*. Thousand Oaks CA Sage

Wright, T.A., Quick, C.J., Hannah, S.T. & Hargrove, M.B. (2017). Best practice recommendation for scale construction in organization research: The development and initial validation on the characteristic strength inventory (CSI). *Journal of organization*. https://www.onlinelibrary.wiley.com

Zhao, P. J., Gao, X. L., Zhao, N. L. & Zhao, S. (2921). Development of the short creative expression interest scale based on item response theory. *Frontiers in Psychology*, 13 https://www.frontiersin.org/articles/10.3389/fpsyg.2022.955176

Zhou, J., Wang, X., Bavato, D., Tasselli, S., & Wu, J. (2019). Understanding the receiving side of creativity: A Multidisciplinary review and implications for management Research. *Journal of Management*, 45(6), 2570-2595.

Final Draft of Creativity Scale for Postgraduate Students Questionnaire (DSCSPSQ)
Section A: Personal Data

Instruction: Please tick (√) the option applicable to you

Gender: Male ☐   Female ☐

Programme   Masters ☐   PHD ☐

Section B

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and on a scale of one to five thick the appropriate circle to the right of the statement to indicate the extent of your feelings about it. There is no right or wrong answers. Do not spend too much time on any one statement. Just give the answers which seem to describe how you generally feel. Please use the following codes: Strongly Agree (SA), Agree (A), Disagree (D); Strongly Disagree (SD).

CREATIVITY SCALE FOR POSTGRADUATE STUDENTS

S/N	ITEMS	SA (4)	A (3)	D (2)	SD (1)
	SELF/EVERYDAY LEVEL	(4)	(3)	(2)	(1)
1	I help other people cope with a difficult situation	(4)	(3)	(2)	(1)
2	I teach someone how to write project	(4)	(3)	(2)	(1)
3	I think of new ways to help people	(4)	(3)	(2)	(1)
4	I choose the best solution to a problem	(4)	(3)	(2)	(1)
5	I plan a trip or event with friends that meets everyone's needs	(4)	(3)	(2)	(1)
6	I try to mediate a dispute or argument between two friends	(4)	(3)	(2)	(1)
7	I do not have capacity of being fluent	(4)	(3)	(2)	(1)
8	I try thinking of new ways to help people	(4)	(3)	(2)	(1)
	SCHOLARLY LEVEL				
9	I respond to an issue in a context-appropriate way	(4)	(3)	(2)	(1)
10	I do not argue a side in a debate that I do not personally agree with	(4)	(3)	(2)	(1)
11	I try figuring out how to integrate critiques and suggestions while revising a work	(4)	(3)	(2)	(1)
12	I figure out the pros and cons of an advanced educational statistics task solution before accepting it.	(4)	(3)	(2)	(1)
13	I offer constructive feedback based after reading of a paper or article	(4)	(3)	(2)	(1)
14	I check my project work for errors before submitting	(4)	(3)	(2)	(1)
15	I cannot combine two ideas from related class works	(4)	(3)	(2)	(1)
	PERFORMANCE				
16	I make contributions in the classroom when learning is going on	(4)	(3)	(2)	(1)
17	I can't do my best at school when I work with others	(4)	(3)	(2)	(1)
18	At school, I performed best when I am praised	(4)	(3)	(2)	(1)
19	In school, I don't perform well so that nobody will praise me	(4)	(3)	(2)	(1)

| 20 | I create original and positive things that are recognized by many people | (4) | (3) | (2) | (1) |
| 21 | I figure out how to fix a research problem | (4) | (3) | (2) | (1) |

MECHANICAL/SCIENTIFIC

22	I enjoy solving analytical problems	(4)	(3)	(2)	(1)
23	I examine a project scientifically before making my conclusion	(4)	(3)	(2)	(1)
24	I figure out alternate hypotheses/questions, when I need to solve a problem	(4)	(3)	(2)	(1)
25	I do not follow scientific procedure in my project writing	(4)	(3)	(2)	(1)
26	I help to carry out or design a scientific experiment	(4)	(3)	(2)	(1)

ARTISTIC

27	Just for pleasure, I strive to find out how things work	(4)	(3)	(2)	(1)
28	I try sketching a schematic representation of concepts in my project	(4)	(3)	(2)	(1)
29	I try to come up with my own interpretation of a classic work of art	(4)	(3)	(2)	(1)
30	I try to appreciate the diagram of a research design	(4)	(3)	(2)	(1)

PSCS Manual

Postgraduate Students' Creativity Scale (PSCS)

Author: Prof N.P.M Esomonu & Dr. C.B. Ikeanumba (2023)

Purpose: To develop, validate and standardize creativity scale for postgraduate students

Description: 30 items scale is designed to access postgraduate students' creativity using

a. Self/Everyday level

b. Scholarly level

c. Performance

d. Mechanical/Scientific

e. Artistic as indicator of postgraduate students' creativity.

Administration: The PSCS should be administered individually or in groups after establishing adequate rapport with the client(s). Please encourage them to read and follow the instruction at the top of test form. You (the professional) may need to help the client carry out the instruction. There is no time limit for completing the PSCS.

Scoring:

There is direct scoring and reverse scoring of the items

    a. **Direct Scoring:** for the relevant item, the response are scored thus

        Strongly Agree   4

        Agree   3

        Disagree   2

        Strongly disagree 1

    b. **Reverse Scoring:** for the relevant items, the responses as scored thus

        Strongly Agree   1

        Agree   2

        Disagree   3

        Strongly disagree   4

    c. **Direct Score Items:** 1,2,3,4,5,6,8,9,10,11,12,13,14,16,18,20,21,22,232,24,26,27,28,29,30

    d. **Reverse Score Items:** 7,15,17,1925

    e. Add the value of the direct score and reverse score items for each of the five component of the PSCS

    f. Add together the scores of the three sub-scales to obtain the overall creativity score.

Psychometric Properties:
Norms

The norms reported here are mean scores obtained from different categories of students (Postgraduate Students)

A (relating to Sense of self/everyday) Male: 12.22 Female: 14.30

B (relating to scholarly) Male: 8.27 Female: 10.31

C (relating to performance) Male: 10.21 Female: 13.32

D (relating to mechanical/scientific) Male: 11.22 Female: 14.21

E (relating to artistic) Male: 10.22 Female: 12.11

F (entire test) Male: 36.10 Female: 40.01

Reliability: A measure of internal consistency was established using the Cronbach Alpha statistic. The result is thus Reliability Co-efficient

1. Self/everyday 0.71
2. Scholarly 0.83
3. Performance 0.76
4. Mechanical/scientific 0.71
5. Artistic 0.86

The entire instrument 0.82

Validity: Construct validity was established using factor analysis with varimax rotation. Only items that loaded adequately were picked.

Interpretation: The norms or mean scores are the basis for interpreting the scores of the postgraduate students. Scores higher than the norms indicates adequate creativity while scores lower than the norms indicate the postgraduate students not do not have adequate creativity. The manual above shows the administrative and scoring procedure of the scale. It also shows the psychometric properties of the scale.