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Undergraduate Project Topic Selection among Takoradi Technical University Students in Ghana: A Principal Component Analysis

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Abstract
The purpose of this paper is to explain the variances between the observed factors related to research project topic selection among final year undergraduate students of Takoradi Technical University in Ghana. A cross-sectional research method was adopted for the study wheretotalcompleted questionnaire of 345 fromthe students were received through the application of convenience sampling technique. The principal component analysis yield a KMO measure of sampling adequacy of 0.750 indicating sufficient items for each factor. The results of this study suggest personal goal, department goal and resource goal as the most important factors related to undergraduate project topic selection which could guide university students and staff in the successful completion of the project work. The limitation to the findings of the study regards the assumption of the adequacy of the constructs to satisfactorily measured students' views on the factors influencing undergraduate research project topic selection in the university. However, the research paper shed important implication for faculty and non–faculty members to provide support to students during the project work process.

Keywords: *Undergraduate Project Work, Topic Selection, Final Year Students, Principal Component Analysis, Takoradi Technical University*

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I. Introduction

Many universities require final year undergraduate students to complete a research project workas a requirement for graduation. In Ghana, final year students of Technical universities mandatory submit project work as part of their curriculum. The project work is regarded as important component of undergraduate curriculum because it offers the students the opportunity to do an independent work, to plan and carry out academic research that they will undertake during their degreeprogramme (Hand &Clewes, 2000;Hussey &Hussey, 1997; Webster et al., 2000).Hussey and Hussey (1997) listed four aims of the undergraduate project work covering problem solving skills,problem identification, information seeking skills and information synthesizing skills. For example, Hand and Clewes (2000) suggested that the undergraduate research project could serve as the foundational ground for students in graduate education.

The selection of undergraduate project topic forms an important components of the research process and completion. On the dissertation topic selection, Clark et al. (1998) caution students that the topic selected should be of high interest and motivation for ensuring successful completion of the research project. Also, Rynes et al. (1999) observed academic research conducted within institutions and suggested that most research work were successfully completed when the student had intrinsic motivation for initiating the research project. Motivation according to Rynes might take many forms such as personal sense of accomplishment of a task or the desire to learn about a subject in the field.

The availability research findings on the topic selection suggest multiple factors accounting students choice of particular topic selected. Some scholars including Barr (1984), Isaac, et al (1989), Kozma (1997), I'Anson and Smith (2004), and Xia (2013) listed personal interest, career aspirations, and perceived ease of access to primary data or the literature, faculty and student related factors to name a few play important role. However, research project work related to topic selection is sparse in literature (Barr, 1984; Isaac et al.,1989; Kozma, 1997; Xia, 2013) where the majority of these research work were conducted among graduate and post graduate students. Therefore, this researcher paper has the purpose of analysing the important factors

influencing project work topic selection amongst students of Takoradi Technical University in theFaculties of Business Studies, Applied Arts and Technology, Applied Sciences, Built and Natural Environment and Engineering pursuing various programmes. Furthermore, the study attempts to explain the variances between the observed factors related to research project topic selection among final year undergraduate students into a few latent components.This paper provides insights into important factors underlying undergraduate project topic selection in higher education as personal, department and resource goal which could guide university students and staff in the successful completion of the project work.

II. Literature Review

2.1 Selection of research topic

Most research studies on topic selection were conducted at the master's or doctoral level and therefore, majority of these studies come from higher degree studies. Many research findings have listed personal interest, career aspirations, potential for publication, candidate's familiarity with the topic's subject, ease of access to secondary data as the important factors affecting research topic selection (Barr, 1984; Isaac et al., 1989; Kozma, 1997; I'Anson and Smith, 2004; Xia, 2013).

In 1989, Isaac et al carried out a large-scale survey research among doctoral graduates in the United States of America. Isaac et al.'s (1989) listed in the order of importance the priorities these doctoral students assigned to the factors related to research topic selection. These included students own preference for the topic, as the top priority, followed by trends in the field of study, students own interest in the topic based on students' live experiences, research topic from advisors, capable for publication, meeting future career aspiration and availability of instruments. They further regrouped these factors related to research topic into three parts as program related, personal related and national politics and one's own life related.

Barr's (1984) carried out a qualitative study on dissertation topic selection among white, male, non-foreign all-but-dissertation students to ensure that "differences found in the research process would not be influenced by differences in the students' sex, race or nationality. She interviewed 17 students and seven mentors on topic selection in the fields of chemistry, English, political science, and sociology. Furthermore, she chose to focus on students whose goals were in academia or research and concluded that factors influencing doctoral students' selection of a dissertation topic were program structure, advisor selection criteria, and advisor's role, criteria of dissertation topic selection, and student growth and development.

Kozma (1997) employed a questionnaire to collect data from doctoral students in education andadministration management in two online programs. A total of 553 surveys made up of 19 education faculty members, 19 administration-management faculty members, 189 education students, and 306 administration-management students out of 900 students and 100 faculty members in the United States of America. Kozma found independent variables such as age, gender, department, and contact frequency with advisors did not determine how students selected a topic. Kozmafurther identified eight factors that students and advisors in the two distance learning programs considered to be important: the topic should be professionally respectable; the topic should be one in which one's interest is very high; the topic should have potential for providing particular experiences that would increase the student's competencies and knowledge; the topic should sustain the student's interest, the topic should be one that could be completed in a reasonable length of time; the topic should be one that could be completed with the expenditure of a reasonable amount of money; the topic's probability of being accepted should be reasonably good; and the study should be a "sound" venture—one not likely to collapse and require a new start. Kozmaregrouped those factors into faculty influence, financial concerns, personal issues, and professional issues. Kozma's goal was to compare faculty and students' perceptions of the factors at play in topic selection especially the role of the mentor.

I'Anson and Smith's (2004) study on undergraduate research projects and dissertations focused on issues oftopic selection, access and data collections amongst tourism management studentsin New Zealand. They found that students'motivation for undergraduate project topic selection was influenced by personal interest, career aspirations, and access to primary data or literature.

Lundstrom and Shrode (2013) investigated undergraduate'stopic selection and the librarian's role. The findings of the study through a focus group discussion revealed among others that perceived of data collection from the participants, pleasing the faculty member and personal interest in the topic.

Xia (2013) evaluated the mixed method study on students' experiences in the selection of a dissertation topic using the current research collected survey and interview data from second- and third-year Ph.D. students in natural sciences, social sciences, and humanities at a large research university in the United States. 80 second- and third-year Ph.D. students completed an online survey; 11 students and four of their advisors participated in a semi-structured interview.The results demonstrate that the majority of students spent over three months in the selection of dissertation topics, and the humanities students tended to spend longer time in this process than social sciences or humanities students. Additionally, students have much in common in their perception of the

criteria they would use in the selection of dissertation topics, and those criteria are similar to what previous researchers (Isaac et al., 1989; Kozma, 1997) have identified.

Olalereet al (2014) conducted a study on the dissertation topic selection of doctoral students using dynamic network analysis. This study examines the dissertation topic selection process of doctoral educationalleadership students in order to understand what influences the student's dissertation topic selection. The emerging approach of Dynamic Network Analysis (DNA) was used to examine the interactions between task, belief, resource and knowledge in determining students' choice. Data was analyzed using the Organizational Risk Analyzers' (ORA) software measures of Newman Grouping, centrality betweenness, cognitive demand, knowledge exclusivity, resource exclusivity, eigenvector centrality, and total degree centrality. The results suggest that topic selection is influenced by faculty member's research agenda, departmental core courses, and network factors like professional experience, life experience and practical experience.

Shazia et al. (2015) examined the time taken for submission of proposal and the level of help provided by supervisor during proposal writing. Multi-centre cross sectional study conducted over a period of six months at tertiary care hospitals of Islamabad and Rawalpindi. A total of 436 postgraduate medical residents were included in the study. The factors leading to selection of dissertation topic were identified: Most of the topics were selected on supervisor's suggestion followed by residents who selected the topic of their own interest performed better while writing the research proposal for dissertation and the supervisors provided maximum help when they have their own interest in the topic selected.

III. Materials and Methods

3.1 Research design and data collection

The population for this study consisted of all final yearundergraduate students of Takoradi Technical University (TTU) in Ghanain 2019 academic year. The research design for this paper was a cross-survey method where the respondents from Applied Arts, Applied Science, Business Studies, Built and Natural Environment,and Engineeringwere selected for the study.The study was purposively delimited to final years writing their research projects. A convenience sampling technique was deployed where the researchers visited lecture rooms of final year students and 345 questionnairewere completed and returned. Therefore, the researchers visited students' lecture halls where respondents were voluntarily participated in the study.

3.2 Reliability and Validity Tests

Cronbach's alpha of internal consistency reliability test was performed for the 10 item questions in IBM SPSS version 20. The alpha reliability test value of0.795 indicates internal consistency among the items in the questionnaires.

The content validity test for the survey scale was adopted based on the past literature review on the topic. The10 item questions on research project topic selection were identified and used for the study were based experts' opinions by Isaac et al., (1989) and Kozma (1997) survey scales. Hence, A 5 point scale rating involved the respondents to decide whether the variable is "Not Important (1)", "Less Important (2)", "Fairly Important (3)", "Very Important (4)" and "Extremely Important (5)".

IV. Results and Discussion

The data analysis section of this research paper presents the descriptive statistics of the data collected from 345 final year undergraduate students of Takoradi Technical University in Ghana. Table 1 shows the mean ranking of the important factors related to undergraduate project topic selection based on the respondents' views of the topic understudy. The mean values above 4.00indicate that the respondents ranked these factors as extremely important for the selection of project topic selection. The topic should be of high personal interest to me recorded the highest mean value of 4.86, followed by the topic should be of high academic interest to me with mean value of 4.53.However, the topic should have potential for institutional, governmental, or other funding recorded very low mean value of 2.88.

Table 1: *Descriptive statistics of important factors related to project topic selection*

Factors	Mean	Std. Deviation	N
The topic should be one that I am familiar with.	4.1420	.57070	345
The topic should be of high academic interest to me.	4.5333	.70271	345
The topic should be of high personal interest to me.	4.8638	.34353	345
The topic should go well with the trend in my field of study.	4.3304	.70779	345
The topic should be tackled with the data that I can easily collect.	3.9391	.79190	345

The topic should improve my opportunities for employment after graduation.	3.8899	.69428	345
The topic should be one that could be completed in a reasonable length of time.	4.0609	.83478	345
The topic should have potential for institutional, governmental, or other funding.	2.884	.7574	345
The topic should be in an area where my supervisor has expertise.	3.4638	1.04241	345
The topic should be offered or suggested to me by a supervisor	3.9768	.88563	345

Source: Data analysis

4.1 Principal Component Analysis

According to Leech et al. (2016) the principal components analysis is a data reduction technique used to reduce a large number of variables to a smaller set of underlying factors that summarize the essential information contained in the variables. The decision about which principal components to retain depends on the percentage of the total variance accounted for the variable, the absolute variance accounted for by each principal component (PC) and whether the component can be meaningfully interpreted. Varimax rotation was used to transform the components into factors that were more clearly interpretable. To facilitate an easier interpretation of principal components, factor rotation methods were developed. This research study uses varimax orthogonal rotation method developed by Kaiser (1958). Principal components with Eigen values greater than one are usually retained.

According to Leech et al. (2016) the assumptions for principal component analysis include: Sample size: A sample of 100 subjects is acceptable; Normality: Principal component analysis is robust to the assumption of normality. The normality of the data was assumed by using the Kolmogorov Smirnov test (significance value was greater than 0.05). Sampling adequacy: Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure the sampling adequacy and can be used to determine the factorability of the matrix as a whole. IfBartlett's test of sphericity is large and significant and if the KMO is greater than 0.6 then factorability is assumed. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index used to examine the appropriateness of factor analysis. High values (between 0.5 and 1.0) indicate factor analysis is appropriate (Leech et al., 2016). To ensure the use of principal component analysis, the Barlett Test of Sphericity (BTS) and Kaiser-Meyer-Olkin (KMO) test of appropriateness were carried out accordingly (Table 2). The results (the BTS at 2542.301and the level of significance at P = 0.000) indicated that the data were appropriate for the purpose of principal component analysis. The result of the KMO measure of sampling adequacy was 0.750 which indicates that there are sufficient items for each factor. The two tests support the appropriateness of the principal component analysis technique.

***Table 2**: KMO and Bartlett's Test*

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.750
Bartlett's Test of Sphericity	Approx. Chi-Square	2542.301
	df	45
	Sig.	.000

Source: Data analysis

Table 3 shows that three components with Eigen values greater than one account for 76.984% of the total variance. According to the rules of principal component analysis only factors that have Eigen values greater than one should be retained.

The results in Table 3 is further supported by the scree plot analysis in Figure 1 below with three eigenvalues above 1.00. According to Figure 1, the three components values are the eigenvalues of 1 as shown in total variance explained results in Table 2 below.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.273	52.731	52.731	5.273	52.731	52.731	4.245	42.447	42.447
2	1.265	12.647	65.377	1.265	12.647	65.377	1.889	18.889	61.336
3	1.161	11.606	76.984	1.161	11.606	76.984	1.565	15.648	76.984
4	.773	7.730	84.713						
5	.546	5.461	90.174						
6	.321	3.206	93.380						
7	.239	2.388	95.768						
8	.181	1.806	97.574						
9	.169	1.686	99.260						
10	.074	.740	100.000						

Extraction Method: Principal Component Analysis.

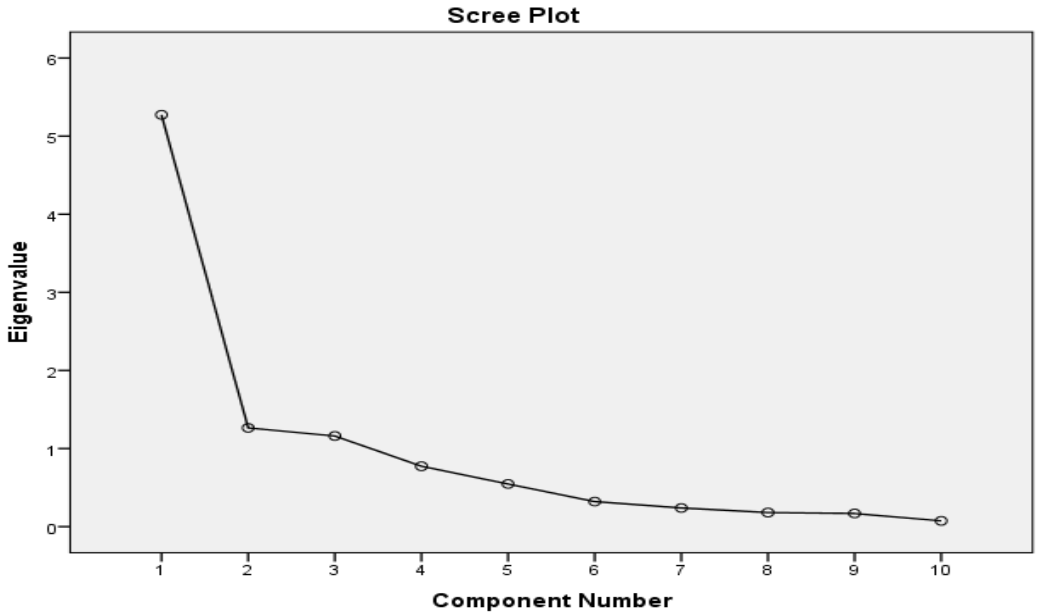

Figure 1: *The Scree plot analysis*

Component 1: Personal goals.

According to Table 4, the first component has an Eigen value of 5.273 and percentage of variance of 52.731%. The component consists of seven items. The items included in this component include the topic should be one that I am familiar with (0.858). This is the item with the highest factor loading.Other items include the topic should have potential for institutional, governmental, or other funding 0.901; the topic should be tackled with the data that I can easily collect, 0.877, the topic should be one that could be completed in a reasonable length of time 0.651; the topic should be one that could be completed in a reasonable length of time 0.606; the topic should improve my opportunities for employment after graduation, 0.601, the topic should go well with the trend in my field of study, 0.589, and the topic should be of high academic interest to me 0.563. Component one is labeled "Personal goal". Personal goal component is largely internal goal or decision guiding the student in the selection of undergraduate project topic selection. This finding can be supported with similar

studies done by various researchers(Barr, 1984; Isaac et al., 1989; Kozma, 1997). According to Isaac, et al (1989), the most important factor among others factors that the doctoral student selected personal preference.

Component 2: Departmental Goal

The second component has an Eigen value of 1.265and percentage of variance of 12.647%. The component consists of three items. These items are: The topic should be offered or suggested to me by a supervisor (0.891), the topic should be of high personal interest to me 0.705) and the topic should be of high academic interest to me (0.503). This component is labeled "Departmental goal".This finding concurred with the study by Olalere et al (2014). Their result showed that topic selection isinfluenced by faculty member's research agenda, departmental core courses, and network factorslike professional experience, life experience, and practical experience.Also, Shazia et al (2015) on the factors leading to topic selection for dissertation writing by post graduate medical residents concluded that most of the topics are selected on supervisor'ssuggestion while personal interest of trainee in theselected field comes after that.

Component 3: The third component has an Eigen value of 1.161 and percentage variance of 11.606 %. This component consistsof two items. The topic should be in an area where my supervisor has expertise (0.955) and the topic should be of high academic interest to me (0.456). The component is labeled as "Resources goal".This finding can be supported with similar studies done by various researchers ((Isaac et al., 1989; Kozma, 1997). According Isaac, et al (1989)grouped their findings into program related; personal related and national politics and one's own life related.

Table 4: ROTATED COMPONENT MATRIX[A]

	Component		
	1	2	3
The topic should be one that I am familiar with.	.858		
The topic should have potential for institutional, governmental, or other funding.	.841		
The topic should be tackled with the data that I can easily collect.	.817		
The topic should be one that could be completed in a reasonable length of time.	.812		
The topic should improve my opportunities for employment after graduation.	.795		
The topic should go well with the trend in my field of study.	.654		
The topic should be of high academic interest to me.	.586	.503	.456
The topic should be offered or suggested to me by a supervisor		.891	
The topic should be of high personal interest to me.		.705	
The topic should be in an area where my supervisor has expertise.			-.955

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]

4.2 Conclusion

The research study concludes that varied factors affected undergraduate students' selection of project topic for the project work. Survey by questionnaire and principal component analysis with varimax approach helped in summarizing the items of factors into three components for easy explaining of the motivation of the research topic selection among Takoradi Technical University students. The three factor components emerged as personal goals for first component, departmental goals as the second component and the third component for resource goal. It can be observed from the first component (personal goal) that factors included in this component are the topic should be one that I am familiar with, the topic should have potential for institutional, governmental, or other funding, the topic should be tackled with the data that I can easily collect, the topic should be one that could be completed in a reasonable length of time, the topic should improve my opportunities for employment after graduation, the topic should go well with the trend in my field of study, and the topic should be of high academic interest to me. Furthermore, the second component labelled departmental goal consisted of three items: The topic should be offered or suggested to me by a supervisor, the topic should be of high personal interest to me and the topic should be of high academic interest to me. It can be observable from the third component that factors like the topic should be in an area where my supervisor has expertise and the topic should be of high academic interest to me play a major role in student project topic selection.

V. Research limitations/implications

The constructs in the study cannot be assumed to have adequately measured students' views on the factors influencing undergraduate research project topic selection in the university. However, the research paper shed important implication for faculty and non–faculty members to provide support to students during the project work process. This paper provides insights into important factors underlying undergraduate project topic selection in higher education as personal, department and resource goal which could guide university students and staff in the successful completion of the project work.

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