Academic Performance of Bachelor of Science Students from Course Structure: A Study in the Faculty of Science and Technology at Suan Sunandha Rajabhat University

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Abstract—**This study investigates the relationship of the academic performance and the courses achievement of undergraduate students at the faculty of science and technology. Linear Regression Analysis and Pearson product Moment Correlation Coefficient are used to determine which courses are significant predictors. The correlation is being categorized from 12 curricula course structure. Data collected is from the sample of 1619 online report submitted by science graduated students who have graduated during the academic year 2013-2017. The results of the study indicate that there is a positive significant linear correlation between the course structure achievement and the academic performance in each curriculum. 100 % of the curricula, require major course achievement have a significant effect on the grade point average. 92% of the curricula, elective major course and professional English courses achievement have a significant effect on the grade point average. Required major course and elective major course are quite strong relationship with academic success.**

Index Terms—**Academic performance, curriculum structure, learning outcome, the proportion of the variation.**

I. INTRODUCTION

In higher education setting and from the lens of educators, any study result or formally academic achievement or performance is the learners' individual development in obtaining knowledge literacy, skills and attitudes. In addition, the academic achievement is also used as an indicator of qualitative characteristics and competencies based on the learning process standardized by higher education institutions [1], [2]. In fact, study result relates directly with various other factors and not limited to the learning process. Bloom cited in [3], identifies Learner himself or herself, Instructors, Learning Activities, and Learning Atmosphere as factors attributed to students' achievement. It can therefore be inferred that learner's academic performance is also the indicator toward any academic institution's achievement in providing the educational services [4] depicts that the Science and Technology undergraduate study results can be attributed to background knowledge or the prior academic performance. Course structure, student grades, failure rate, awards and achievement and GPA can be useful for the assessment curriculum at the end of a stage or year .Routine data gathered

at the end of courses can also provide a picture of the curriculum's progress. Moreover, assessment informs students' progress then before students graduate, curriculum design team need evidence that students have achieved the required learning to progress [1]. Thailand has a framework for higher education that requires graduates of all levels to meet at least five learning outcomes which are moral skill, knowledge skill, intellectual skill, interpersonal relationship and responsibilities skill, and numerical analysis, communication and information technology skill. To achieve these learning outcomes, it is necessary to design courses in a curriculum having relationship among the various subjects matter to create coherence and avoid gaps on the framework of the curriculum. A curriculum design is an important mechanism that will lead to the production of qualified graduates according to the aspiration of each course [5]. The curricula in Science and technology Faculty of Suan Sunandha Rajabhat University have designed theirs curricula structure consisting of 8 different courses which are general education courses, core courses, required major courses, elective major courses, professional English courses, management science courses, project and internship courses, and free elective courses. This organized balance the discipline knowledge with other more generic skill and attempt to develop students ability .The students should receive some indicator of how they will progress through the curriculum. To contribute to quality assurance and improve student learning, curriculum assessment is a systematic process for gathering and evaluating information on students' progress. Therefore, the study academic performance from course structure is a way of curriculum assessment in order to know how much each courses in the curriculum results in a successful completion of the course and address the challenge of coherence in curriculum organization. The objective of this study is investigates the relationship of the academic performance and the courses achievement of undergraduate students at the faculty of science and technology categorized from 12 curricula.

II. THE STUDY

A. The Data Gathering Stage

The primary data employed in this study is from the students' academic results reported to the university's registrar system and who are the graduates of the Faculty of Science and Technology, Suan Sunandha Rajabhat University in Thailand during the academic year 2013-2017. In fulfilling

the study objectives, the sample of 1619 online reports submitted are used based on cluster sampling technique. The number of online reports submitted in each program are presented in Table I.

Program	Sample number
Applied Physics	57
Applied Statistics	141
Biology	144
Biotechnology	55
Chemistry	74
Computer sciences	239
Environmental Sciences	146
Food Industry and Service	139
Home Economics	120
Informatics Mathematics	57
Industrial Microbiology	72
Information Technology	375

B. Variables

In this study, the Academic performance is measured by using Grade Point Average (GPA) is being assigned as a dependent variable in regression analysis. An average score level of subjects in each group (core courses, required major courses, elective major courses, professional English courses, management science courses, project and internship courses) are calculated and are used as independent variables in each curricula or the program of study .

C. Statistical Analysis

Pearson product Moment Correlation Coefficient is useful when the research tried to determine whether two variables are related, the strength of the relationship between the variables and what type of relationship exist. Simple and multiple linear regression are designed to summarize and study relationships between average score level of each group

and grade point average and to predict the influence of x_i (course structure) on y (the academic performance). The coefficient of determination or r-squared value denoted r^2 is use to determine percent of the variation in y explained by the variation in predictor x [6].Factor analysis is a multivariate statistical procedure that can use to reduce a large number of variables, [7]. Factor analysis is a method for investigating whether a number of variables of interest are linearly related to a smaller number of unobservable factors [8]. In this study, factor analysis is used to group the linearly related independent variables into factor.

III. FINDING

Finding of the study indicated that there was a positive significant correlation between required major courses achievement and their academic performance all programs at 0.05. Elective major courses achievement and academic performance were linearly related all programs except Industrial Microbiology program. Professional English courses achievement related with their academic performance in all programs except Food Industry and Service program. There was a positive significant correlation between core courses achievement and their academic performance all programs except Computer sciences, Environmental Sciences and Food Industry and Service programs. Project and internship courses achievement and their academic performance were linearly related all programs except Applied Physics, Biology and Informatics Mathematics programs. Management science courses achievement and academic performance were linearly related all programs except Applied Physics and Industrial Microbiology programs. The Pearson Correlation and partial correlation coefficients are presented in Table II.

TABLE II: THE CORRELATION AND PARTIAL CORRELATION COEFFICIENT

		Course structure					
		core	required major	elective major	professional English	project and internship	management science
Applied Physics	correlation	0.660	0.713	0.519	0.355	0.204*	0.159*
	partial	0.246*	0.393	0.170*	0.065	-0.009*	-0.070*
Applied Statistics	correlation	0.772	0.907	0.900	0.548	0.452	0.693
	partial	0.404	0.611	0.667	0.033*	0.148*	0.485
Biology	correlation	0.261	0.935	0.845	0.752	0.170*	-
	partial	0.090*	0.656	0.380	0.339	0.194*	-
Biotechnology	correlation	0903	0.937	0.903	0.763	0.429	-
	partial	0.744	0.653	0.372	0.443	0.433	-
Chemistry	correlation	0.901	0.946	0.866	0.793	0.350	-
	partial	0.635	0.707	0.341	0.555	0.090*	-
Computer sciences	correlation	0.023*	0.917	0.815	0.387	0.165	-
	partial	0.005*	0.811	0.629	0.64	0.042*	-
Environmental Sciences	correlation	0.002*	0.778	0.168	0.545	0.400	-
	partial	0.006*	0.680	0.113*	0.346	0.284	-
Food Industry and Service	correlation	0.01*	0.965	0.856	0.027*	0.540	0.672
	partial	0.101*	0.885	0.305	0.016*	0.276	0.351
Home Economics	correlation	0.917	0.251	0.884	0.404	0.538	0.702
	partial	0.807	0.076*	0.692	0.512	-0.023*	0.397
Informatics Mathematics	correlation	0.832	0.920	0.828	0.683	0.205*	-
	partial	0.532	0.350	0.565	0.185	0.142*	-
Industrial Microbiology	correlation	0.817	0.844	0.010*	0.466	0.205*	0.622
	partial	0.347	0.475	-0.112*	0.008*	0.029*	0.311
Information Technology	correlation	0.766	0.120	0.796	-	0.261	-
	partial	0.565	0.045*	0.63	-	0.211	-

*Not significant

TABLE III: PREDICTED LINEAR REGRESSION MODELS

Program	Regression model	R^2_{adj}	Durbin	Standard Residual (max)
Applied Physics	$GPA = 2.947 + 0.253 \times (factor\ score1) + 0.149(factor\ score2)$ $factor\ score1 = 0.660C + 0.799R + 0.827EN$ $factor\ score2 = 0.709E + 0.852M$	0.519	1.557	2.649
Applied Statistics	$GPA = 2.726 + 0.379 \times (factor\ score1)$ $factor\ score1 = 0.912R + 0.881E + 0.851C + 0.771M$	0.922	1.680	2.058
Biology	$GPA = 2.874 + 0.386 \times (factor\ score1)$ $factor\ score1 = 0.941R + 0.886E + 0.838EN + 0.403C$	0.869	1.590	1.909
Biotechnology	$GPA = 2.758 + 0.426 \times (factor\ score1)$ $factor\ score1 = 0.937R + 0.930E + 0.888C + 0.825EN + 0.453P$	0.956	1.602	2.465
Chemistry	$GPA = 0.508 + 0.809R$	0.893	1.939	2.406
Computer sciences	$GPA = 2.703 + 0.290 \times (factor\ score1) + 0.091(factor\ score2)$ $factor\ score1 = 0.939E + 0.923R$ $factor\ score2 = 0.764EN + 0.738P$	0.895	1.618	2.473
Environmental Sciences	$GPA = 2.813 + 0.260 \times (factor\ score1)$ $factor\ score1 = 0.827R + 0.745EN + 0.598P$	0.630	1.488	2.297
Food Industry and Service	$GPA = 0.475 + 0.699R + 0.107M$	0.940	1.477	2.268
Home Economics	$GPA = 2.898 + 0.321 \times (factor\ score1) + 0.230(factor\ score2)$ $factor\ score1 = 0.841P + 0.755M + 0.693E + 0.628C$ $factor\ score2 = 0.831R$	0.888	1.486	2.073
Informatics Mathematics	$GPA = 0.223 + 0.408C + 0.480E$	0.908	1.882	3.159
Industrial Microbiology	$GPA = 0.935 + 0.679R$	0.712	1.763	2.169
Information Technology	$GPA = 0.962 + 0.665E$	0.632	1.472	2.124

C represents core courses average grade, R represents required major courses average grade, E represents elective major courses average grade , EN represents professional English courses average grade, M represents management science courses average grade, P represents project and internship courses average grade

Required major courses achievement shows quite strong association with academic performance in all programs except Home Economics and Information Technology programs. Results of the linear regression analysis are presented in Table III. They indicate that are 51.9 % of the variation in students' academic performance is explained by their core courses, required major courses, elective major courses, professional English courses and management science courses achievement in Applied Physics program but project and internship courses achievement is not factor for predicting the academic performance. For Applied Statistics program core courses, required major courses, elective major courses, and management science courses achievement explain the variation in students' academic performance about 92.2% but professional English courses and management project and internship courses achievement are not predicted factors. Biology students' academic performance is explained by their core courses, required major courses, elective major courses, and professional English courses achievement about 86.9% but project and internship courses achievement is not predicted factor. 95.6% of variation in Biotechnology students' academic performance is explained by core courses, required major courses, elective major courses, professional English courses, and project and internship courses achievement. 89.3% of variation in Chemistry students' academic performance is explained by only required major courses achievement. Like Chemistry program only required major courses achievement explain variation in Industrial Microbiology students' academic performance about 71.2%. For Information Technology program, elective major courses achievement is only one factor which explain variation in students' academic performance. Computer sciences students' academic performance is explained by their required major courses, elective major courses, professional English courses and project and internship courses achievement about 89.5% but core courses achievement is not predicted factor. 63% of variation in Environmental Sciences students' academic performance is explained by required major courses, professional English courses, and project and internship courses achievement but core courses and elective major courses achievement are not predicted factors. 94% of the variation in students' academic performance is explained by their required major courses, and management science courses achievement in Food Industry and Service program but core courses, elective major courses, professional English courses and project and internship courses achievement are not factor for predicting the academic performance. 88.8% of the variation in students' academic performance is explained by their core courses, required major courses, elective major courses, management science courses, project and internship courses achievement in Home Economics program but professional English courses achievement is not factor for predicting the academic performance. 90.8% of the variation in students' academic performance is explained by their core courses and elective major courses achievement in Informatics Mathematics program but required major courses, professional English courses and project and internship courses achievement are not factors for predicting the academic performance. The courses achievement predictors in each program are presented in Table IV. The showed that there is no course being predictor in all program but required

major course is the strong factor effect on the grade point average. 75% of the curricular, the grade point average resulted from required major course achievement. On the other hand, project and internship course and professional English courses achievement is not important role of predictor.

TABLE IV: THE PREDICTOR IN EACH PROGRAM

Program	Course structure					
	core	required major	elective major	professional English	project and internship	management science
Applied Physics	√	√	√	√	×	√
Applied Statistics	√	√	√	×	×	√
Biology	√	√	√	√	×	-
Biotechnology	√	√	√	√	√	-
Chemistry	×	√	×	×	×	-
Computer sciences	×	√	√	√	√	-
Environmental Sciences	×	√	×	√	√	-
Food Industry and Service	×	√	×	×	×	√
Home Economics	√	×	√	×	√	√
Informatics Mathematics	√	×	√	×	×	-
Industrial Microbiology	×	√	×	×	×	×
Information Technology	×	×	√	-	×	-

√ present the predictor, × present not predictor, - present do not have this course in program

IV. CONCLUSIONS

This study aims at identifying the correlation among academic performance and the success in taking subjects in each course structure and to confirm that the latter has direct influence and impact on the former for the graduates of Science curricula in offer. The result of conducting the study depicts the correlation of success in taking subjects in the course structure and the academic achievement using Grade Point Average (GPA) represented in linear shape. The tendency of high correlation is appeared in the Food Industry and Service, Biotechnology, Applied Statistics, Informatics Mathematics, Computer sciences, Chemistry, Home Economics and Biology program of study representing linearity of $r^2 > 0.8$. Furthermore, the study does further support that success in taking subjects in required major course, core course and elective major courses can be employed to predict the academic achievement of students. However, the design and development of the curricula program play a critical role in students' learning experience and all subjects in curriculum are crucial in realizing learning objective [5]. Curriculum design should develop efficient studying skills in order for learning objectives to become actual learning outcome [9]. In order to achieve the objectives of the course, Curriculum development team can consider the results of this study are preliminary data for in-depth analysis and design course structure In terms of scope, Sequence, Continuity, Integration, Articulation and balance[1]. Since core course and some subjects in required major course are offered during the first or second year of study, the success in taking these subjects are inevitably of vital source of preliminary indicator in providing necessary assistance to the student taking any program of study.

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