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The Challenging Development of ICT Professionals and Thailand 4.0 Success: A Prediction of Academic Performance of CS Graduates

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ABSTRACT
"The shortage of ICT professionals in Thai workforce has been appeared…Most of ICT professionals were developed form CS background."[5] Thus, CS (Computer Science) graduates are seen as ICT professional, who take a vital role of country driving to Thailand 4.0 success (placing on innovation and creativity) Quantity is not important, comparing to quality of CS graduates because all of the existing graduates could not be developed becoming the ICT professionals. In this research, based on only CS graduates' school record database collected from 4 courses in 2 semesters from 1994 – 2016. Additionally, 8 ICT-related employers were also interviewed to meet their requirement of CS graduates' academic performance. Statistical regression analysis and the results of interviews were incorporated for predicting academic performance. The results revealed that mathematics and programming are significant in predicting academic performance. Finally, the factors identified from this process allow new strategies to be drawn for improving academic performance in the future. It is as a five floors building of a challenging transformation of CS teaching-learning process paradigm shift from traditional learning (passive learning) to formative (smart) learning (active learning).
Keywords – Academic performance, Computer Science, Graduates, Prediction, Thailand 4.0

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I. INTRODUCTION

Human resource is a key factor of country development. In each budget year, a biggest buck has been set up for ministry of education in Thailand.[8] Thai government wants to move the country into a new era-Thailand 4.0, defined by innovative technology-based manufacturing and services. The success of the 4.0 strategy is in reach if the domestic capacity can be added by new technologies, encompassing smart Information and communication Technology (ICT) professionals. However, it is found that overall, Thailand's economy is considered in particular of the shortage of skilled personnel.[7] Therefore, it is a challenging development of ICT professionals in both quantity and quality to drive Thailand 4.0 success.

Quality in particular, quality assurance in education is weighted to guaranty in graduation. Thus, in this research, the researcher predicted academic performance of CS graduates to inform a guideline for the improvement of graduations' process. Finally, there will be good enough ICT professionals to drive Thailand 4.0 success.

OBJECTIVES

This research aims to predict academic performance of CS graduates and to inform a guideline to improve the CS teaching-learning process for driving Thailand 4.0 success.

II. RELATED WORKS

2.1 Thailand 4.0

"Thailand 4.0 is an economic model that aims to unlock the country from several economic challenges resulting from past economic development models which place emphasis on agriculture (Thailand 1.0), light industry (Thailand 2.0), and advanced industry (Thailand 3.0)."[9] Thailand 4.0 places on innovation and creativity. This will move Thailand towards prosperity, security, and sustainability. Four objectives of Thailand 4.0 is [9]

(1) Economic Prosperity that is driven by innovation and technology and creativity
(2) Social well-being.
(3) Raising human values, and
(4) Environmental protection.

This is the challenging transformation of Thailand paradigm shifts: traditional farming to smart farming, tradition SMEs to start ups, traditional services to high values services, unskilled labors to knowledge workers, and buy technologies to make technologies. All of them are needed ICT professionals as an important tool to support its transformation. Thus, Thailand 4.0 success depends

on good enough skilled ICT professionals, say CS professionals.

2.2 CS Graduates

At present, university produce ICT graduates in a variety of curricula, such as, Computer Science (CS), Information Technology (IT), Computer Games and Multimedia, Software Engineering, Information System, etc. However, CS is seen as an original and a core program of the rest ones. Additional, "CS study is involved with being ICT professionals… CS graduates could work without any more trainings and they have a good enough basic knowledge and logic for self-learning. Thus, ICT jobs are waited for CS graduates."[5] Thus, This research focuses on CS graduates-theoretical and practical in computing and IT-related technology.

2.3 The Traditional Statistical Method

From the review literatures, a number of researchers have compared the performance of the traditional statistical methods and neural networks in different kinds of real life problems.[4] Some of them found that neural network model was formed to perform better than statistical method.[2][10][11] Nevertheless, Sengupta [12] noted that the regression method has performed better than the neural network method for the specific problem described in his paper. However, results obtained, can't be generalized as indicators of relative strengths of the two modeling approaches. But the outcomes of both of methods are in the same direction. Thus, multiple regression analysis could be used in this research.

"Regression analysis is one of the most widely used of all statistical methods. It is a technique meant to establish statistical relationship among variables. The obtained information is formulated into an equation, which is then used to predict the dependent variable based on given values for the independent variables."[4]

In general, if there are n independent variables, x_i i = 1, 2, 3,…n and one dependent variable Y, the goal of regression is to find values for n+1 coefficients, β_0, β_1, β_2, …, β_n such that the relationship can be modeled by the equation (2.1)

$$Y = \beta_0 + \sum_{i=1}^{n} \beta_i x_i + e \_\_\_\_\_ (2.1)$$

Where Y is the value of the regression variable; β_i's are the regression parameters to be estimated; x_i's are the known predictors of the dependent variable and e is the random error term. [4]

2.4 Graduation Predictive Factors

Geiser and Santelices concluded that high school GPA was the best predictor of degree completion.[1] The researcher also interviewed eight ICT employers and all of them agreed that Cumulative GPA (CGPA) at the last academic year is the most important indicator of graduation success. In addition, they discussed and concluded that students who graduated with a high CGPA and high grades in mathematics and programming subjects will have tendency of good logic and self-learning.

Thus, this research will try to predict academic performance of graduates via CGPA, mathematics, and programming capability.

III. RESEARCH PROCEDURE

3.1 Data Collection

The required data for this research was collected from Rangsit University, Thailand database. Only CS graduates' data were compiled in Excel format which included student identity number, CGPA at semester eight, grade of subjects: calculus 1&2, Programming 1&2 at semester one and two, respectively. Data were collected from academic year 1994-2016, resulting in 802 CS graduates.

3.2 Data Processing and Analysis

This research, the researcher used multi-regression analysis with stepwise refinement. SPSS was used for data processing and analysis, as follows:

Step 1: considering CGPA as dependent variable and calculus1 as independent variable. The estimated regression model is

CGPA = 2.157 + 0.245 Cal1 _____(3.1)

The value of R^2 for the model is 0.286, that is, the regression model accounts for about 28% of the variability in cumulative GPA. This might be because of some unknown variables contributing to CGPA.

The researcher continued with this variable for further analysis.

Step 2: Adding calculus 2 as independent variable. And the estimated regression model is

CGPA = 1.943 + 0.204 Cal1 + 0.134 Cal2

_____(3.2)

The value of R^2 for the model is 0.399, that is, the regression model accounts for about 39% of the variability in CGPA.

Additional, from the interview of employers, they agreed that not only mathematics impacts good logic of graduates, but also programming courses. Thus, the researcher continued with programming courses for further analysis in step 3 and 4 respectively.

Step 3: Considering programming 1 as independent variable. The estimated regression model is

CGPA = 1.952 + 0.265 Prog1

_____(3.3)

The value of R^2 for the model is 0.347, that is, the regression model accounts for about 34% of the variability in CGPA.

Step 4: Adding Programming 2 as independent variable. The estimated regression model is

CGPA = 1.814 + 0.167 Prog1 + 0.159 Prog2

_____(3.4)

The value of R^2 for the model is 0.429, that is, the regression model accounts for about 42% of the variability in CGPA.

Step 5: Finally, the researcher considered all of them (cal1, cal2, prog1, prog2) as dependent variables. The estimated regression model is

CGPA = 1.501 + 0.130 Cal1 + 0.095 Cal2 + 0.104 Prog1 + 0.162 Prog2

_____(3.5)

The value of R^2 for the model is 0.620, that is, the regression model accounts for about 62% of the variability in CGPA.

The model turns out to be significant and the predictor variables Cal1, Cal2, Prog1, and Prog2 are found to be statistically significant in predicting academic performance. The value of R^2 for the model is 0.620, higher percentage of the variability in CGPA. However, the rest of 38% might be because of some unknown variables contributing to CGPA. Therefore, the model is appropriate to be used to measure the academic performance of the CS graduates.

IV. RESULTS

The estimated regression models in equations (3.1)-(3.5) show the results obtained for academic performance of the CS graduates. It means that both of calculus and programming subjects are statistically significant in predicting academic performance of CS graduates.

It can be seen that academic performance could be planned to be higher than the actual one. Thus, strategic intervention and actions can be suggested or proposed by the lecturers so as to improve the final CGPA upon graduation. However, it is noted that CS students have another five more semesters after these four classes or before reaching the final semester for graduation. Thus, it is better to advise CS students and lecturers as early as possible upon detection of poor performance at completion of first year. This can be followed by strategic actions to be applied taken to remedy the situation of the need of strong support for Thailand 4.0 success. At least, the much earlier remedy actions will be able to improve academic performance at the end of first year instead of waiting for graduation.

V. STRATEGIC ACTIONS GUIDELINE TO IMPROVE ACADEMIC PERFORMANCE OF THE CS GRADUATES

In this section, strategic actions will be proposed for some practical steps. The CS dependent chair and lecturers can do or follow to help improve the CS degree students' academic performance before graduation. The overall guideline can be summarized as follows:

(1) Basic must be tight: Basic knowledge- the base of building, including mathematics and programming, etc. Mathematics is for good logics and problem solving and programming is as a skill of technician, engineer, or craftsman who is an expert, applying programming tool in creative and innovative software production.

(2) Less teach and learn more: Skill could not be formed by teaching but self-learning, because skill needs practices. Teaching-learning process paradigm shift is challenge from teaching to learning. [3]

(3) Formative learning or project-based learning: Students practice in a project team under real world problems during courses taken. Thus, they can blend and apply their knowledge to form a work effectively. Teamwork and communication skills will be also practices.

(4) Endless learning: Both lecturers and students should learn together as a team because knowledge, especially, in ICT field has rapidly changed. Thus, research skill should be focused in both of them. This is an active learning. Lecturer must be as a knowledge translation model. Students must be a graduate who is self-learning, that is, they could learn and track new knowledge and technology- never ends.

(5) Creativity and Innovation: Students must have inspiration in life and career skills. Thus, they could learn to change themselves to be compatible with Thailand 4.0 and technology changed. They are also creative and could change their ideas into innovative software production.

Figure 5.1 shows a five floors building of strategic actions to improve academic performance of CS graduates for driving Thailand 4.0 success.

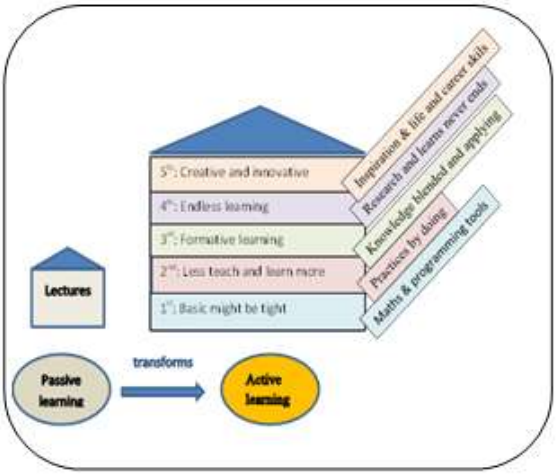

Figure 5.1 A Five Floors Building of Strategic Actions to Improve Academic Performance of CS Graduates

VI. CONCLUSION

This research has presented some of regression models to predict the academic performance of CS graduates. The results turn out to be significant and the predictor variables Cal1, Cal2, Prog1, Prog2 are found to be statistically significant in predicting academic performance. This indicates that mathematics and programming grades could be used to predict CS student academic performance. Even though computer science is not a programming study, but programming is a vital tool in its study and career skills. The research outcome implied that mathematics forms a good logic and problem solving. Additionally, programming creates students' capability in software development. If software is as a building, then mathematics and programming would be as an important tool in constructing that building. Thus, the results of the research indicates that basic of mathematics and programming must be tight and then before reaching the final semester for graduation, students have learned more another knowledge. They could blend, apply, and transform these contents to application under real-world problem project-based practices without any problems of programming skill. Thus, students will graduate with their high academic performance. According to Thailand 4.0 success, it would be creative and innovative products.[6] Therefore, in Thailand 4.0, smart city, smart farming, AI, robots, etc. will be seen in society. All of them are creative and innovative software products, driven by ICT professionals. This is an important reason that computer science graduates would be a challenging development in Thailand 4.0 success.

Finally, it is expected that a prediction of academic performance of CS graduates leads to propose strategic actions guideline to improve academic performance of CS graduates which would be valuable for driving Thailand 4.0 success.

REFERENCES

Journal Papers:

[1]. Geiser, S. and Santelices, M.V., Validity of High-School Grades in Predicting Student Success Beyond the Freshman Year: High-School Record VS Standardized Tests as Indicators of Four-Year College Outcomes, Berkeley Center of Studies in Higher Education, ROPS, June 1, 2007. Available at: https://cshe.berkeley.edu

[2]. Guo, W.W., Incorporating Statistical and Neural Network Approaches for Student Course Satisfaction Analysis and Prediction, Expert Systems with Applications, 37(2016), 3358-3365. Available at: www.elsevier.com/locate/eswa

[3]. Panich, W., Graduates Development in 21st Centuries, Suranaree Journals, 6(2), 2012.

[4]. Pariwal, M., and Kumar, U.A., A Study of Academic Performance of Business School Graduates Using Nerual Network and Statistical Techniques, Expert Systems with Applications, 36(2009), 7865-7872. Available at: www.elsevier.com/locate/eswa

[5]. Titthasiri, W., Efforts to Revitalize the Computer Science Education in Thailand, Inter. Journal of Engineering Research and Applications, 6(2)(Part-4), 2016, 34-41. Available at: www.ijera.com

Books:

[6]. Kachinthorn, U., Thailand Education 4.0 (MOE, Thailand: MOE Digital Team, 2019). Available at: www.moe.go.th

[7]. The Economist, Thailand 4.0: in sight but not in reach, Nov.16th, 2017. Available at: www.country.eiu.com.

[8]. Chapters in Books:

[9]. Budget Bureau, Handbook of Budget: budget year 2019, (Thailand: Office of the Prime Minister, 2019) 91.

[10]. Royal Thai, Thailand 4.0, (Thailand: Embassy, Washington D.C., 2019. Available at: www.thaiembdc.org

Proceedings Papers:

[11]. Arsad, P.M. Buniyamin, N. and Manan, J.A., A Neural Network Students' Performance Prediction Model (NNSPPM), Proc. IEEE Inter. Conf. on Smart Instrumentation, Measurement and Application (ICSIMA), Kuala-Lumper, Malaysia, 2013, 26-27.

[12]. Lesinski, G.L., Corns, S., and Dagli, C., Application of Artificial Neural Network to Predict Graduation Success at the United States Military Academy, Proc. Computer Science, 95(2016), 375-382. Available at: www.sciencedirect.com

[13]. Sengupta, S., A Comparative Studyof Neural Network and Regression Analysis as Modeling Tools, Proc. Of the 27th Southeastern Symposium IEEE on System Theory, USA.,(1995), 202-205. Available at: www.ieeexplore.ieee.org

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