Analyzing The Senior High School Students' Learning Attitude And Cognition Toward Computer Science Education

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***Abstract*—Information technology have flourished, various types of computer- assisted system designed on our daily life, how they sustain system quality and affect the system performance are therefore essential for enterprises' operating capacity. Knowledge of computer science is considered as one of the core competencies, while technology systems have been widely applied in many industries. The need to cultivate the science knowledge is engaging learners' attention in making practice. This paper reports a preliminary study that investigates the key factors affecting learning among senior high school student expect computer science education. The aim of this study was to assess the learning attitude toward computer science education, and the study also investigated the self-perception of leaner which based on the potential cognition load in the learning effectiveness and motivational appeal. The sample was 70 senior high school student students. The experimental results show that the participants have a 95% probability of requirement to learn the computer science knowledge which indicated that the student have learning interesting of computer science education. Data analyses showed that the student percept computer science knowledge is difficult. The results point that the senior high school student learning attitude and self-perception on the college computer science education, learners also provide the relevant suggestion on the purpose of making efficient college computer education.**

***Keywords*— Learning attitude, computer science education, self-perception**

I. INTRODUCTION

In recently, innovative techniques system was widely used in different specialized domain. Related scholars proposed that the computer science education is necessary ability to improve competencies of graduate. Computer programming course [1] [2], for example, which are required learner to practice exercises [3]. To cultivate good programming ability and obtain the relevant experience, there are two potential challenge students may be met. First, students easily lack of the learning interesting in learning activity, especially when they were repetitive failed to practise on their own [1]. Second, teachers have the problems that efficiently guide the new student to realize the kernel principle [2]. A view of some studies indicates that knowledge acquisition and sharing is considered as the process of learning which is dynamically shaped by various factors [6]. The needs to improve the teaching and learning performance are the mental reflection analysis which can be affected by environmental and cause the different learning outcome [4] [5]. This paper investigates the students' attitude and self-perception for computer science education which can regard as the guideline to develop the computer science learning activities.

II. RELATE WORK

With the repaid development of technology, learning the knowledge of computer science is not constrained by specialized domain. The knowledge of computer science programming is one of the universe skills. Therefore, computer science education has attracted a considerable amount of attention from researchers, especially promoting learning attitude and reduce the cognition difficulty. Computer science courses are the universal demanding, some studies have been investigated the programming education, and these studies teach students with knowledge of basic programming concepts [7]-[9]. Students easily influence by the failure experience and prior related impressions in computer science education [5]. The learning efficiency and motivation is concerned with learning environment and material. Accordingly, the development of learning activity can consider the factor of mental reflection. Mental reflection (e.g. learning motivation) is highly complex facets of learning behavior. Learners decide to learn from their experiences which is consisted a set of determinants. The motivating factors have been a prominent research topic in the field of higher education [5]. Motivation perceived as an enabler for learning and academic success [10]. In the case of learning computer science knowledge, leaner engagement in practice needs to sustain motivation. Therefore, this study aims to analysis based on the motivations factor- learning attitude and self-perception.

III. ANALYSIS

In this study, we develop the on-line questionnaire consisted of 3dimension: learning attitude, self-perception of difficulty, learning expectation and suggestion. Fig.1 is the interface of digital survey that based on the web technology. Fig. 2 illustrated the architecture of the digital survey. Three types of evaluation dimension: learning attitude and self-

perception, and expectation employed in this study. As learners finish the on-line survey, the results collected into learning profile for data analysis. On the purpose of discovering the effect of mental reflection, knowledge management (KM) and statistical test employed to data analysis. Finally, the analysis result could feedback to teacher as the suggestion of design the learning activity.

Fig. 1 The interface of on-line questionnaire

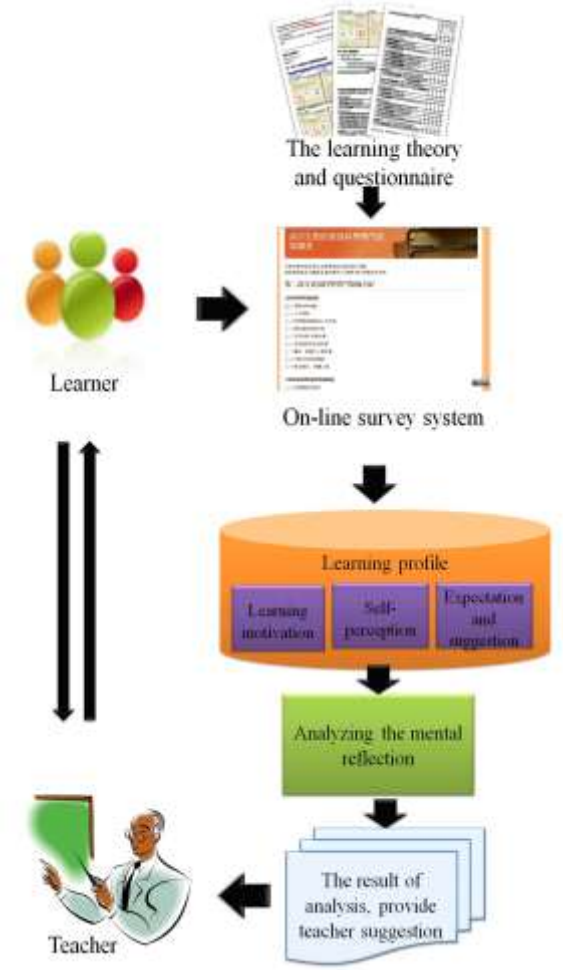

Fig. 2 The architecture of the proposed on-line multimedia approach

A. *Experimental design*

This study aims at analyzing learning attitude and cognition toward computer science education. The data source is therefore essential for multimedia preference analysis and performance evaluation. Fig. 3 showed the participants' information, we collected data from 69 participants consisted of teachers and students. The 73% of participants is male, and the proportion of participants is in the North Taiwan, the midst Taiwan, the South Taiwan, the East Taiwan, and remote islands in Taiwan (e.g. Quemoy) are 50%, 27%, 19%, 3%, and 1%, respectively.

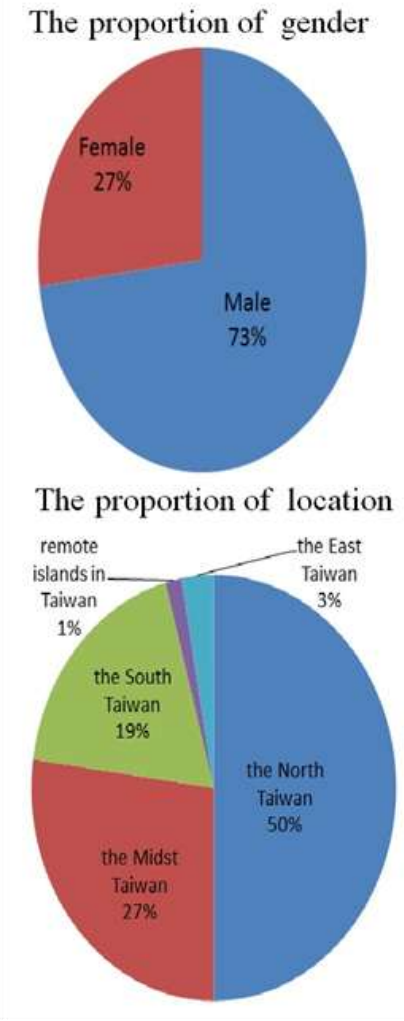

Fig. 3 The result of participants' information

The collected parameters is displayed in Table 1. For the purpose of adapting the analysis result in real cases, the mental reflection evaluation based on the cognition load and learning attitude included in the research questionnaire. All participants completed the experiment in approximately a half of hour, and they were paid US $ 5 dollars to participate. The Cronbach's α value of the questionnaire were 0.79, implying that the questionnaire is reliable.

TABLE I
THE VARIABLE OF LEARNER PREFERENCE SURVEY.

Variables	Description	Type
ID	Identify sample	Numerical
Gender	1=Male 2=Female	Categorical
Location	1= the North Taiwan 2=the Midst Taiwan 3=the South Taiwan 4=off-shore Taiwan 5=the East Taiwan	Categorical
Self-perception of difficulty	The seven dimension used to measure : (1) Students have prior understanding of computer science education can engage them into learning. (2) Students have prior understanding of computer science education can enhance their learning performance. (3)Students have intention to learn computer science knowledge. (4) Students have the learning wellness to take some relance fundamental knowledge. (5) Prior understanding of computer science education is essential information for students (6) Students have interesting toward software. (7) Students have interesting toward hardware.	Categorical
Learning attitude	The five dimensions used to measure : (1) Students percept the software design is difficulty. (2) Students percept the middleware design is difficulty. (3) Students percept the hardware design is difficulty. (4) In self-evaluation, students believe it is hard to learn the software knowledge. (5) In self-evaluation, students believe it is hard to learn the hardware ware knowledge.	Categorical

B. *Analysis of learning attitude toward computer science education*

In this study, 5-point Likert type questionnaires with response options of strongly agree to strongly disagree (type=1-5) measure the level of learners' learning attitude. Q1-Q7 have significant high (p-value <0.05) learning attitude towards the computer science education (See Table 3). Fig. 4 Most of participant concerned about the prior understanding, before they taking the computer science education in college, it means that the computer science concept can make learner more engage into learning.

TABLE II
THE LEARNING ATTITUDE EVALUATION

Item	Mean	*p*	t-value
Q1	1.41	.000	19.19
Q2	1.74	.000	12.97
Q3	2.04	.000	6.69
Q4	2.03	.000	9.19
Q5	1.76	.000	13.51
Q6	1.87	.000	9.52
Q7	2.54	.001	3.61

Fig. 4 is shown the result of multimedia preference evaluation. Most of participants have preference for animated based game on not only the proposed system, but also their self-perception. The preference result of static text is interesting, the few proportion of participants percept their favourite material is the static text material. While they had used the proposed material, the preference of static text had drastically growth. The audio material had the fewest of preference on the proposed approach in this study. It might be influenced by the content of learning, the problem-solving scenarios is hard to present with a single audio material.

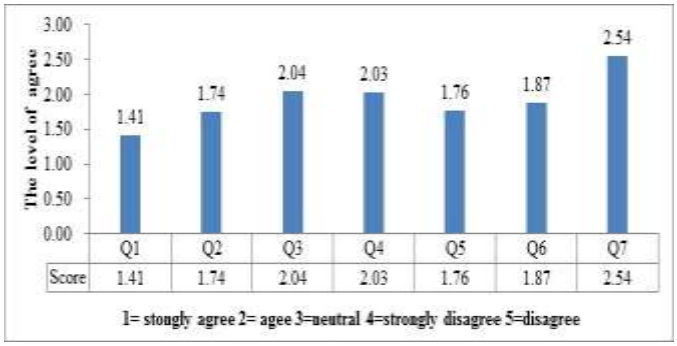

Fig. 4 The result of the learning attitude analysis

C. *Analysis of self-perception toward computer science education*

The five items were separately included in the cognition load evaluation: Q1-Q5. Moreover, we examined the significance of these items. The response options were scored with a Likert's five point scale ranked from strongly difficult (1 point) to strongly easy (5 points), to examine whether the mean of each item was significantly different from the median.

In this study, we used a t-test to separately examine the questionnaire items. In addition, the lower score mean the participants have strong agreed on the view we proposed. Table 3 illustrated that score of each questionnaire item concerned with the static text. The results show that the participants have a 95% probability of obtaining an above-average high self-perception of difficulty. In particular, participants had significantly high cognition load (t=2.53 p-value = 0.000 < 0.05, t-value= 4.4) on learning the software knowledge (See Fig.5).

TABLE III
THE LEARNING ATTITUDE EVALUATION

Item	Mean	*p*	t-value
Q1	2.33	.000	7.25
Q2	2.20	.000	8.09
Q3	2.11	.000	9.38
Q4	2.53	.000	4.40
Q5	2.17	.000	8.32

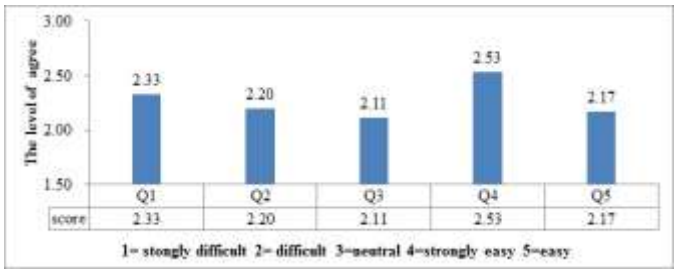

Fig. 5 The result of the cognition load analysis

Table 4 shows the correlation matrix, this study also found that the cognitive loads of software have significant positive correlation with hardware (Pearson's correlation coefficients=0.42, p = 0.000<0.05). The result demonstrated that the student feel learning software knowledge is difficult, also feel learning hardware is difficult.

TABLE IV
THE CORRELATION MATRIX BETWEEN COGNITION LOAD OF HARDWARE AND SOFTWARE

		Hardware	Software
Hardware	Pearson's correlation coefficients	1	0.42
	Sig.	.000	
	N	70	
Software	Pearson's correlation coefficients	0.42	1
	Sig.	.000	
	N	70	

IV. CONCLUSION

In this study, we analyzed the learning attitude and self-perception of difficulty. Real cases were applied in the experiment and assured that the reliability of information. Our experiment shows that students have more prior understanding of computer science education, and more motivate to learning relevant knowledge. In integral analysis, the students expect that learning computer science is difficult (2.3). The students obtained the high level of cognition load in software learning; they also obtained the high level of cognition load in hardware learning. Therefore, the analysis result is useful for teacher to make teach strategy and design the learning activity. The teacher could provide the preview of computer science course, introduce the concept, and develop the learning activity to reduce the cognition load. Moreover, software learning is relevant with hardware learning, cultivating concept of software knowledge such as programming is essential for leaner to improve the learning attitude and cognition load. The main contributions of this study are: (1) Determining the relationship between software learning and hardware learning. (2) This study also pre-measured student's mental reflection before them taking computer science education in college. In future studies, we would expect to develop the programming concept learning system to cultivate the prior knowledge. To toward the development of personalized learning, future studies aim to automatically feedback the useful information can to the teacher with the intelligent agent system.

REFERENCES

[1] K. M. Law, V. Lee, and Y. T. Yu, "Learning motivation in e-learning facilitated computer programming courses", *Computers & Education*, vol. 55, no. 1, pp. 218-228, 2010.

[2] T. Jenkins, "The motivation of students of programming", *ACM SIGCSE Bulletin*, vol. 33, no. 3, pp. 53-56, 2001.

[3] M. Papastergiou, "Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation", *Computers & Education*, vol. 52, no. 1, pp.1-12, 2009.

[4] T. Jenkins, "The motivation of students of programming", *In Proceedings of ITiCSE 2001: The 6th annual conference on innovation and technology in computer science education*, pp. 53–56, 2001.

[5] K. M. Y. Law, F. E. Sandnes, H. Jian, and Y. Huang, "A comparative study of learning motivation among engineering students in South East Asia and beyond", *International Journal of Engineering Education*, vol. 25, no. 1, pp.144–151, 2009.

[6] W. W. F. Lau, and A. H. K. Yuen, "Exploring the effects of gender and learning styles on computer programming performance: Implications for programming pedagogy", *British Journal of Educational Technology*, vol. 40, no.4, pp.696–712, 2009.

[7] L. Werner, J. Denner, M. Bliesner, and P. Rex, "Can middle-schoolers use Storytelling Alice to make games?: results of a pilot study", *InProceedings of the 4th International Conference on Foundations of Digital Games*, pp. 207-214, ACM, April 2009.

[8] J. Denner, L. Werner, and E. Ortiz, "Computer games created by middle school girls: Can they be used to measure understanding of computer science concepts?" *Computers & Education*, vol. 58, no.1, pp. 240-249, 2012.

[9] C. Y.Feng, and M. P. Chen, "The effects of goal specificity and scaffolding on programming performance and self-regulation in game design", *British Journal of Educational Technology*, 2013.

[10] E. A. Linnenbrink, and P. R. Pintrich, "Motivation as an enabler for academic success", *School Psychology Review*, vol. 31, no.3, pp.313-327, 2002.