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INVESTIGATING COMPUTER LEARNERS' STRATEGIES ON COGNITIVE AND BEHAVIORAL CONTROLS

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Abstract

The purpose of this study is to investigate the learners' learning styles and strategies from different backgrounds, to analyze how these variables of individuals work on problem-solving skills and to achieve the ultimate goal of being employed as professionals in the computer field. The investigation was performed by 117 students learning computer at a vocational training institution. The questionnaire was composed of learning strategies, including cognition/behavior controls and problem-solving skills with problem-solving confidence, approach-avoidance and personal control. There appeared the correlation between learning strategies and problem-solving skills. In

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detail, the three factors of learning strategies - check, time and study control, and pursuing assistant strategies are found to affect problem-solving skills. These three meaningful strategies are practical and thus, can be applied to teachers and students in computer education.

1. Introduction

The Fourth Industrial Revolution, which is addressed at the Davos Forum, introduces several areas that represent a revolution in new fields such as the Internet of things, big data, augmented reality and smart manufacturing. Technology is open to anyone, and data scientists in various fields are coming into the spotlight to communicate with open minds, rather than cultivating a group of experts in one field. IT based job training is open to graduates from not engineering related majors because many students are increasingly avoiding natural science and engineering. Many of the game developers and IT professionals of S/W and design fields are from vocational training courses on the Ministry of Employment and Labor [1]. The final objective of this paper is to present effective teaching and learning methods to identify the relationship between the computer learners' learning strategies and problem-solving skills for a professional career in IT. The study of this paper is as follows:

- Research on learning strategies.

- Research on problem-solving skills.

2. Related Researches

2.1. Learning strategies

Zimmerman's theory is the most widely used in the field of self-regulated learning. According to his definition, "self-regulation is not a mental ability or an academic performance skill; rather it is the self-directed process by which learners transform their mental abilities into academic skills". "Self-regulation of learning involves more than detailed knowledge of a skill. It involves the self-awareness, self-motivation, and behavioral skill to implement that knowledge appropriately [2].

Yang and Jeong tried to conceptualize new self-regulation learning by collecting professors' various thoughts and adding the need for motivation/emotional regulations [3].

2.2. Problem-solving skills

Humans lead a professional life while living their own lives and many job skills are required for this purpose. The concept of professional competence is based on a variety of definitions across countries and researchers.

According to the definition of [4], vocational skills are a totality of skills required to successfully perform a given job in professional life. Vocational competencies are classified as vocational basic skills and job performance skills. First, vocational basic skills are basically required knowledge, skills, attitudes and experiences in order to successfully complete the job. Humans lead a professional life while living their own lives and many job skills are required for this purpose. Job performance is professional knowledge, skills and attitudes required to successfully carry out their duties in a particular occupation or profession [4].

The problem-solving skills are defined by various nations and scholars. The problem-solving skills are defined by various national and scholars. According to the UK QCA (qualifications and curriculum authority), the problem-solving skills are the ability to devise an approach that can be processed to identify and evaluate the characteristics of the problem. Singapore WDA (workforce development agency) is defined as the ability to evaluate and predict creating a solution to make the problem [5].

3. Research Methods

The research was conducted at *D* institutions in Daejeon. Aimed at students belonging to the *D* institutions, a total of 119 surveys were conducted for 8 days from October 17, 2014, to October 24, 2014. Among 119 results, except two error data showing the missing value, 117 response result data were analyzed.

3.1. Learning strategy investigation

To measure the student's learning strategies, Jeong [6]'s self-regulating learning checks were used. A subcomponent of the controlling factor whether the total consists of four is the reliability of the scale Cronbach α. 89, action control reliability is Cronbach α. 90, and the whole question of reliability is Cronbach was verified by α. 91. A measure of the response to each question was designed for the 6-point Likert (1 point = not at all, 6 points = very Yes) [7].

3.2. Problem-solving skills

Problem-solving skills are developed by Heppner and Peterson [8] scale (personal problem-solving inventory; PSI). The reliability of the whole questions is Cronbach α. 90. A measure of the response to each question was designed for the 6-point Likert (1 point = not at all, 6 points = very Yes).

3.3. Data analysis method

This study is analyzed using SPSS Statistics 20.0 program on the basis of the survey results in order to figure out learning strategies and problem-solving skills for each factor in the field of computer vocational training sector targeted adult men and women.

4. Findings and Analysis

4.1. The learning strategy, problem-solving abilities of descriptive statistics

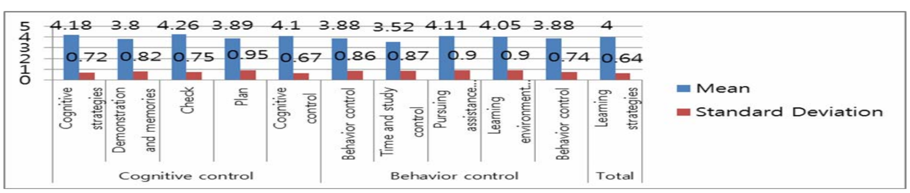

Figure 1. Descriptive statistics of learning strategies.

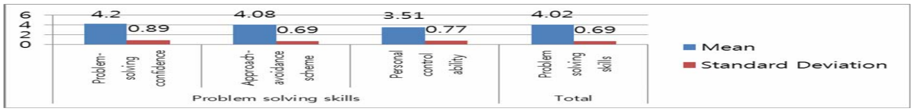

Figure 2. Descriptive statistics of problem-solving ability.

4.2. Learning strategies - the effect of cognitive control on behavioral control

Learning strategies compose of 2 parts: cognitive control and behavioral control. According to the Pearson correlation coefficient, cognitive control and behavior control are correlated with .662. Therefore, cognitive control and behavior control are statistically significant.

Cognitive control was used as an independent variable, behavior control was used as a dependent variable, and periodic analysis was conducted to examine the specific effects of cognitive control on behavior control.

The overall model predicted behavioral control significantly $(F = 89.693, p < .001)$, and the model R-squared ratio was 43.8%, indicating the relationship between cognitive and behavioral controls. The regression equation is 'behavioral control $= .908 + .725 * $ cognitive control'. The regression coefficient is statistically significant. Behavioral control was a significant variable. Thus, behavioral control can be explained by cognitive regulation.

4.2.1. The impact of sub-factors of cognitive control on behavior control

In order to study the specific effects that cognitive control influences on behavior control, sub-factors (remember, cognitive strategies, demonstration and checking, planning) of cognitive control were set as independent variables, behavior control were set as dependent variables. Multiple regression analysis is conducted.

There is no multicollinearity. The model is statistically significant $(F = 25.698, p < .001)$, the model summary R squared is 47.9%. 'Check' and 'planning' factors are $p > .05$, they are meaningless. If we look at the beta value, 'cognitive strategies' is .575 and larger than .195 of 'demonstration and memories', thus, 'cognitive strategies' affects more than 'demonstration and memories'.

Table 1. Multiple regression between sub-factors of cognitive control and behavior control

Independent variable	*B*	*SE*	β	*t*	*p*	R^2	Adj. R^2	*F*
Constant	.996	.316		3.150	.002			
Cognitive strategy	.517	.109	.507	4.762	.000***			
Demonstration and memory	.195	.086	218	2271	.025*	.479	.460	25.698
Check	–.139	.119	–.142	–1.168	.245			
Plan	.148	.078	.191	1.884	.062			

Note: Dependent variable is behavior control

*** $p < .001$, * $p < .05$

4.3. The correlation of learning strategies and problem-solving skills

According to the Pearson correlation coefficient, problem-solving abilities and learning strategies are highly correlated with .776. Therefore, learning strategies and problem-solving ability are statistically significant.

4.3.1. The correlation of the factors of problem-solving skills and learning strategies

Problem-solving skills are composed of 3 factors: 'confidence', 'approach-avoidance' and 'personal control'.

4.3.1.1. Learning strategy factors and their impact on problem-solving confidence

The model is statistically significant $(F = 12.114,\ p < .001)$ and the regression model description is 47.3 percent. The factors that meet probability are 'check $(p = .021)$' and 'time and study control $(p = .027)$'. Both 2 factors are plus, thus, 'check' and 'time and study control' have a positive impact on problem-solving confidence. The beta value of 'check' is .303 and this is larger than .279 of 'demonstration and memories'. Therefore, 'check' affects more than 'demonstration and memories'.

Table 2. Multiple regression between learning strategies and problem-solving confidence

Independent variable	B	SE	β	t	p	R^2	Adj. R^2	F
Constant	.442	.409		1.083	.281			
Cognitive strategy	.192	.149	.156	1.289	.200			
Demonstration and memory	–.028	.116	–.026	–.240	.811			
Check	.357	.153	.303	2.335	.021*			
Plan	–.122	.100	–.120	–1.117	.226	.473	.434	12.114
Effort control	.135	.108	.132	1.252	.213			
Time and study control	.284	.127	.279	2.242	.027*			
Aid seeking strategy	.058	.098	.059	.595	.553			
Study environment control	.053	.110	.054	.486	.628			

Note: Dependent variable is self-confidence in problem-solving

$^{*}p < .05$

4.3.1.2. Learning strategy factors and their impact on approach-avoidance

Models are statistically significant $(F = 30.149,\ p < .001)$, and the regression model description is 69.1 percent. The factors that meet probability are 'check $(p = .005)$', 'time and study control $(p = .000)$' and 'pursuing assistance strategies $(p = .017)$'. The factors have a positive impact on the approach-avoidance scheme. The beta value of 'time and study control' (.418) is larger than 'check (.282)' and 'pursuing assistance strategies (.185)'. Therefore, 'time and study control' affects more than these 2 factors.

Table 3. Multiple regression between learning strategies and approach-avoidance

Independent variable	B	SE	β	t	p	R^2	Adj. R^2	F
Constant	.718	.244		2.943	.004	.691	.668	30.149
Cognitive strategy	.163	.089	.171	1.840	.068			
Demonstration and memory	–.116	.070	–.139	–1.674	0.97			
Check	.259	.091	.282	2.839	.005*			
Plan	.039	.060	.053	0.648	.518			
Effort control	–.086	.064	–.107	–1.328	.187			
Time and study control	.332	.076	.418	4.392	.000***			
Aid seeking strategy	.142	.059	.185	2.421	.017*			
Study environment control	.111	.065	.144	1.698	.092			

Note: Dependent variable is approach-avoidance in problem-solving

$^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$

4.3.1.3. Learning strategy factors and its impact on personal control

Models are statistically significant ($F = 7.708$, $p < .001$), and the regression model description is 36.3 percent. The factor that meets probability is ‘time and study control ($p = .001$)’.

Table 4. Multiple regression between learning strategies and personal control

Independent variable	*B*	*SE*	β	*t*	*p*	R^2	Adj. R^2	*F*
Constant	1.357	.390		3.477	.001	.363	.316	7.708
Cognitive strategy	.094	.142	.088	.663	.509			
Demonstration and memory	–.068	.111	–.073	–.610	.543			
Check	–.008	.146	–.008	–.054	.957			
Plan	.040	.095	.050	.421	.675			
Effort control	0.56	.103	.063	.540	.590			
Time and study control	.417	.121	.472	3.453	.001**			
Aid seeking strategy	–.050	.094	–.058	–.529	.598			
Study environment control	.102	.105	.118	.972	.333			

Note: Dependent variable is approach-avoidance in problem control

** $p < .01$

5. Conclusion

The most required things for computer learners with job-seeking motivation are problem-solving skills and learning strategies before occupational techniques. ‘Check’, ‘time and study control’ and ‘pursuing assistance strategies’ are key elements for problem-solving skills. Teachers should design their class considering these factors, so the learners’ learning strategies get activated under the best conditions.

The result of this study can be used in various fields. In order to generalize the results, there should be further studies at similar environments and curriculum from vocational institutions with a variety of research methods.

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